Natural Resources Inventory

Town of Fremont, New Hampshire

August 2008

Water Resource Management Plan
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Acknowledgements

The Fremont Natural Resources Inventory was written by members of the Fremont Conservation Commission with assistance from the Rockingham Planning Commission. Conservation Commission members are:

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1.0 Introduction

Fremont is a predominantly suburban community with the 2007 population estimated to be 4,300 by the Town Planning and Building Department. The town covers 11,142 acres in southeastern New Hampshire, and is located in Rockingham County along the Exeter River. Fremont's rural character in combination with the rivers, streams, forests, and farms provides a high quality of life for Fremont residents and excellent habitat for native plants and animals.

New Hampshire's population is increasing more rapidly than any other state in the Northeast, and Fremont is one of the fastest growing communities in Rockingham County. The population grew 16% between 2000 and 2005; double the statewide rate for New Hampshire. The NH Office of Energy and Planning estimates Fremont's 2020 populations will be 4,600. Fremont, along with the other towns in the state, must accept the challenge of conserving significant resources in the face of increasing development and population pressures. This report should provide the community with a sound foundation upon which land use decisions can be based.

2.0 What is a Natural Resources Inventory?

This Natural Resources Inventory (NRI) is a description and analysis of the significant natural resources found in the town of Fremont. It covers water, wildlife, forest, natural communities, agricultural, and soil resources. It also identifies lands in Fremont that have been permanently conserved to protect their natural resources for the benefit of future generations.

This information is intended to be a resource for landowners, town officials, and citizens who are the long-term stewards of Fremont's natural resources. Specifically, it can be used to:

- Educate and promote awareness about Fremont's natural resources;
- Document current conditions so changes over time can be assessed;
- Develop natural resource protection and land conservation priorities and a plan for Fremont;
- Provide a basis for master planning, ordinance revisions and planning decisions.[1]

An NRI is never "finished" as the availability of new data and new mapping capabilities make it necessary to update the inventory periodically. Information in this inventory was compiled from many sources. References and acknowledgements are found at the end of this report.

3.0 Goals

The goals of this project are two fold: 1) identify what kind of natural resources are in Fremont and where they can be found, and 2) to use this information to develop a plan for the protection and preservation of these resources. Community support for these goals was made clear during

[1] Stone, Amanda J.L., *Natural Resources Inventories, a Guide for New Hampshire Communities and Conservation Groups,* UNH Cooperative Extension, Durham, NH, 2001.

the development of the Vision Section of the Town's Master Plan. Two public workshops held in May and June of 2005 provided residents with the opportunity to discuss what they like and do not like about Fremont, and to develop a vision for future land use in Town. Residents stated they like Fremont's forests and Spruce Swamp, and they like the undeveloped landscape of town, especially the open spaces. Residents stated they do not like the high taxes which they believe are forcing people to develop land.

Residents described a vision for future land use in Fremont that includes no new development in existing farmlands, changes in land use regulations to enable conservation subdivision (which require permanent open space), and the maintenance of existing open space and wildlife habitat. This NRI can provide the information necessary for this vision to become reality.

4.0 Natural Resources Inventory Maps

Natural resources for Fremont were mapped by the Rockingham Planning Commission (RPC) in 2004 and updated in 2007. These maps were completed using Geographic Information Systems (GIS) data from different sources and at different scales. The RPC uses data from GRANIT (Geographically Referenced Analysis and Information Transfer) from the University of New Hampshire's Complex Systems Research Center. These GIS maps have combined information from several sources into a common scale and format. It is important to remember that this analysis is not accurate for site specific information.
(See all maps in Appendix A)

4.1. Land Cover

See appendix "A" for Land Use Map

The Land Use Map is the base map for the NRI, showing the current land use zones, forest cover, surface water resources such as Spruce Swamp and the Exeter River, and wetlands. Fremont encompasses 11,142 acres, or 17.4 square miles. Mixed forest is the predominant land use, covering approximately 45% of town. Table 1 lists other land use categories as determined by satellite photography.

The land cover data for table 1 was generated by the Complex systems Research Center at the University of New Hampshire Using Landsat Thematic Mapper (TM) satellite imagery. The data may misrepresent the areages of the particular land cover classes because of the type of imagery used. Landsat TM collects images where the smallest pixel is thirty (30) meters square. The details within the 30-meter square pixel are "blended" into one classification. Therefore smaller areas maybe overpowered by other land covers within the pixel. As for the accuracy of the land cover classes, the data was assessed for accuracy and found to be 82.2% accurate for the full 23-class level.

Table 1. Fremont Land Cover – 2001 GRANIT

Land Cover	Acres	Percent
Mixed Forest	5062	45.4
Cleared/Other	1373	12.3
Beech/Oak	758	6.8
Forested Wetland	666	6.0
White/Red Pine	634	5.7
Water	552	5.0
Other Hardwood	478	4.3
Transportation	427	3.8
Open Wetland	393	3.5
Hay/Pasture	353	3.2
Disturbed	199	1.8
Hemlock	174	1.5
Residential/Commercial	58	.5
Orchards	13	.18
Row Crops	2	.02
Total	**11142**	**100.00**

4.2 Open Space and Land Permanently Protected from Development

See appendix "A" for Open Space Map

The Open Space Map displays conservation land, town owned land, areas identified by the Conservation Commission for protection from development, and developed areas. Conservation land is land that is deed restricted from development. The map also shows areas approved for development in 2003, proposed for development in 2004, and areas developed since 1998.

Mapping Fremont's conservation lands help identifies potential needs and opportunities for expanding these areas to provide links between protected areas, and to add protected buffers to sensitive areas.

Table 2. Conserved Land and Conservation Easements in Fremont

Parcel Name	Acres	Road	Tax Map & Lot	Easement	Date	Town Owned	Easement Deed Book & Page #
Anderson	15.35	Old Ridge	M6/L060	Yes	7-1-08	No	B/4932 P/1919
Glen Oakes	312	Andreski Drive	M2/L156-002-001	Yes		Yes	B/4592 P/1054
Vetter Green Space	12.1	Beede Hill Rd/Vetter Drive	M6/L011-001-061	No		No	
Vacant Land	.67	Clover Ct	M03/L167-004	No		Yes	
Lawrence	23.69	Copp Drive	M4/ L077	Yes/private		No	
Copson Corp	5.23	Copp Drive	M2/L156-001-024	No		Yes	
Dakota Realty Trust Phase I	18.2	Dakota Drive	M1/L035-008, -009 & -038	Yes	7/20/01	No	B/3615 P/0702
Dakota Realty Trust Phase II	26.3	Dakota Drive	M1/L035	Yes	9/13/04	No	B/4360 P/0968
Vacant Land	.48	Danville Road	M02/038	No		Yes	
Bolduc	6.2	Emerson Drive	M2/L078	Yes	6/26/97	No	B/3233 P/0529
Meadow Land	7.0	Exeter River	M01/L019	No		Yes	
Vacant Land	2.62	Hook Road	M02/L022-033-002	No		Yes	
Vacant Land	1.0	Lisa Avenue	M03/L168-076 & 078	No		Yes	
Vacant Land	.13	Main Street	M3/L105-001	No		Yes	
Vacant Land	.37	Main Street	M03/167-004	No		Yes	
Vacant Land	.66	Main Street	M02/L009-001	No		Yes	
Vacant Land	1.47	Main Street	M02/L050	No		Yes	
Boggs Bridge	4	No road	M01/L036	No		Yes	
Exeter River Lot	1.0	No Road	M01/L021	No		Yes	
Vacant Land	5.9	Red Brook Road	M02/L073-003	No		Yes	
Vacant Land	8.01	Red Brook Road	M02/L073-002	No		Yes	
Vacant Land	.37	Riverside Drive	M07/L031-001	No		Yes	
Vacant Land	.37	Riverside Drive	M07/L031-001	No		Yes	
Vacant Land	.92	Riverside Drive	M07/L115	No		Yes	
Fremont Pizzeria	<1	Route 107	M03/L119	Yes	12/9/04	No	B/4435 P/1986
Demeritt	<1	Rt 111A	M02/L182	No		No	
Vetter Green Space	12.1	Shirkin Road	M6/L011-001-062	No		No	

Seacoast United Soccer Club	9.9	Shirkin Road	M06/L20-001	Yes	12/6/04	No	B/ 4408 P/1234
Vacant Land	1.67	Shirkin Road	M05/L047	No		Yes	
Vacant Land	6.93	Shirkin Road	M06/L011-001-062	No		Yes	
Vacant Land	12	Shirkin Road	M05/L014	No		Yes	
Vacant Land	.10	Shirkin Road	M05/L052	No		Yes	
Vacant Land	.12	Sunny Lane	M07/L106	No		Yes	
Spruce Hill	59	Tavern Road	M06/L050	Yes	8/6/04	No	B/4342 P/1206
Oak Ridge	173.41	Tavern Road	M04/L004, -008,009, 010,011,012 &016	No		Yes	
Scribner Estates	16.77	Thunder Road	M02/L001-007,008, 009, 010 & 011	Yes		No	B/4890 P/1139
Vacant Land	.05	Tibbetts Road	M07/L020	No		Yes	
Tuck Woods Phase I	18.30	Tuck Drive	M06/L064-021,022 & 023	Yes	3-6-03	No	B/3972 P/1691
Tuck Woods Phase II	36.41	Tuck Drive	M04/L094, & 094-048	Yes	1/20/04	No	B/4247 P/1418
Vetter Green Space	9.0	Vetter Drive	M06/L011-001-045 & 046	No		No	B/2594 P/1605
Exeter River Lot	3.10	Whitman Drive	M02/L077/002 A	No		Yes	
Vacant Land	.19	Whitman Drive	M02/L077/002 B	No		Yes	
Fire Pond	18.9	Whittier Drive	M03/L169-058	No		Yes	

4.3 Geologic Resources

See appendix "A" for Geologic Resources Map

The Geologic Resources Map displays surficial geology and bedrock geology. Surficial geology includes existing sand and gravel pits and areas of town with potential for sand and gravel pits. Bedrock geology includes the types of materials found underneath the soil.

Like the rest of New England, Fremont was shaped by glaciation. The motion of the glacier moved large amounts of rock and soil materials and smoothed the surface giving a more rounded appearance to the surface. However, the glacier also left us with coarse, stony and often infertile soils.

By combining knowledge of the physical environment with what is known of the distribution of plants and animals, the U.S. Forest Service has divided New Hampshire into the following three principal biophysical or ecological regions or sections:

- Southern New England Coastal Plain and Hills Section (southeastern part of NH);
- Vermont-New Hampshire Upland Section (southwestern part of NH);
- White Mountain Section (Northern part of NH).

Fremont is located in the Southern New England Coastal Plain and Hills Section which can be further divided into three subsections:

- Gulf of Maine Coastal Lowland (immediate coastal region);
- Gulf of Maine Coastal Plain (southern portion);
- Sebago-Ossipee Hills and Plain (northern portion).

Fremont is in the Gulf of Maine Coastal Plain, a subsection characterized by broad, hilly plateaus and drumlins leading to the coastal zone.

4.4 Unfragmented Lands

See appendix "A" for Unfragmented Lands Map

Unfragmented lands are undeveloped sections of Fremont with few or no roads. These areas include forest blocks, open water, wetlands, farmland, and gravel pits. These blocks are unrelated to ownership boundaries. This map also highlights existing conservation land, developed land, and town owned land.

Large blocks of forest, wetlands and farmland that are unfragmented by development or public roads are valuable for many reasons. They:

- provide essential forest interior habitat for species such as some songbirds that need to be distanced from human activity, pets, and the forest edge in order to survive;
- provide habitat for mammals that have large home ranges and prefer to avoid human contact, such as bobcat, otter, and moose;
- enable owners of large parcels of forestland to conduct timber harvests that are economically viable;
- minimize conflicts that can arise when managed forests and farms are surrounded and interspersed with development;
- offer opportunities for remote recreation, including hunting, hiking and snowmobiling, where permitted by landowners.

Larger fragments are more likely to support viable populations of species and therefore act as a source of individuals that can then move to another fragment. Small fragments may be unable to support breeding populations. Persistent fragmentation may also lead to genetic changes and a loss of genetic diversity as populations are subdivided into small locally breeding populations.

Many large blocks of forestland are still intact in Fremont. The 2006 *Land Conservation Plan for New Hampshire's Coastal Watersheds* Forest Ecosystems Map highlights three High Value Forest Ecosystem Zones in Fremont. These zones can be seen in Map X of this report.

Table 3 lists the acreage requirements for wildlife in New England as estimated by NH Fish and Game.

Table 3 Unfragmented Block Requirements Per Species

Acres	Species
25	Minimum size for breeding pair of whip-poor-wills
100	Minimum size for a red-shouldered hawk
100	Area required for viable population of wood thrush
500	Approximate maximum dispersal area for wood, spotted or Blanding's turtle
1200	Minimum home range for northern goshawk
1320	Maximum home range for Cooper's hawk
3900-6144	Minimum home range for lynx
9400	Area required for breeding pair of northern goshawks
23,616	Average home range of male bobcat in Maine

4.5 Farmlands

See appendix "A" for Farmlands Map

The Farmlands Map displays three types of farmland information: prime farmland, farmland soils of statewide importance, and areas of agricultural land use in Fremont. Prime Farmland Soils, as defined by the US Department of Agriculture Natural Resource Conservation Service (NRCS), are soils that produce or have the potential to produce the highest yields with minimal expenditure of energy and economic resources. Soils of Statewide Importance are lands, in addition to prime farmland, that are of statewide importance for the production of food, feed, fiber and forage. In a state as heavily forested as New Hampshire, fields and other farmland provide habitat for a variety of wildlife species and are important elements of scenic vies. Farmlands also provide an important historic link to Fremont's past. This map also highlights developed areas that occur adjacent or on farmland soils. Preserving Fremont's productive farmland will help insure locally grown produce and a sustainable future for the citizen's of Fremont.

Agricultural land is valued in Fremont for the food that its farmers produce, some of which is locally available, and for the potential of increased food production. It is also valued for its scenic beauty and diverse habitat. Fremont's farmers and farm families help other residents connect with the town's rural heritage and promote better land management. Much of the character of the town we owe to those who have sustained their farms and agricultural lands for generations.

New Hampshire is losing its most productive farmland. Between 1982 and 2000, nearly 18,000 acres of prime farmland became unavailable for production of crops, feed, forage or fiber. Most was lost to urban and rural development. Only 2% of New Hampshire soils classify as prime farmland. Prime Farmland is defines as land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber and oilseed crops and is also available for these uses. Cropland, usually the most productive agricultural land, has declined 30% statewide from 1974 to 2000. Discussions with residents indicate a growing concern with the future of Fremont's rural heritage. Increasing expenses and lower profits from farming are factors. The pressure from escalating development and rapidly increasing land loss through subdivisions is a major concern.

An analysis of 2001 landcover data shows that 13 acres of the town was in orchard, 2 acres was in row crops and 353 acres were in hay or pasture. There are many Fremont residents who hay or have their fields hayed but are not commercial operations. It should be noted that the above is not an inclusive list as there are numerous other residents unknown to us who have horses, sheep, chickens and other livestock. In addition, many people raise vegetables, fruit and herbs for their own consumption and to share with their neighbors.

Grasslands are an ever diminishing and crucial requirement for many birds, including meadowlarks, bobolinks, woodcock, and killdeer which are under increasing pressure from loss of habitat. The 2006 NH Fish and Game Wildlife Action Plan estimates there are 509 acres of grasslands in Fremont, with .7% of these lands protected from development through conservation easements.

4.6 Forest Resources

See appendix "A" for Forest Resources Map

The Forest Resources map highlights productive forest soils that have been rated by NRCS for productivity for timber production. For this project, three categories of productive forest soils have been identified: 1A, 1B, and 1C. Soils labeled 1A are fertile well-drained, have few limitations for forest management, and are best suited for hardwood. Soils labeled 1B are loamy and sand soils that are moderately well-drained and best suited to hardwoods. Soils labeled 1C are somewhat droughty, less fertile sand and gravel areas that are excessively well-drained and best suited for softwood, especially white pine. Fragmentation of large tracts of forested acreage into smaller unmanageable units is a problem of statewide concern. This map also shows conservation land, managed forestland and tree farms, surface waters and wetlands.

Fremont's forests provide valuable habitat for plant and animal populations. The forests absorb rainwater, increase groundwater infiltration, and buffer surface waters from sedimentation and contamination. Near roads and homes, trees cool summer temperatures by 10 degrees or more, break winter winds, and filter dust and pollutants from the air. Forests host scenic recreational trails and hunting grounds. New Hampshire's tourist industry and seasonal residents are attracted by healthy forests. In addition, well-managed forests provide a sustainable supply of maple syrup, home firewood and commercial wood products and jobs needed by New Hampshire residents.

A forest is not merely a stand of trees. It is usually the total assemblage of trees; the substrate (soil or rock) on which they depend for anchorage and support, nutrition, moisture, and supply of oxygen to the roots; the other plants with which they interact in terms of mutual shelter, competition, benefit or antagonism; the animals that feed on, shelter under, or benefit the plants; the microorganisms that exert direct or indirect beneficial or antagonistic effects on the trees and other living organisms; and the soil and atmospheric climate, including fire and moisture, that influence the distribution and abundance of all the organisms in the forest.

A forest is comprised of several forest types. Forest types are distinctive associations or communities of trees, shrubs, and herbaceous plants. They are named for the predominant tree species occurring in the type. Common forest types in Fremont include White Pine; Northern Hardwood (sugar maple, beech, yellow birch, red maple, white ash and smaller amounts of other species); Spruce-Fir, Red Oak, Hemlock, and Aspen-Birch. A forest type may be dominated by a single tree species or it may dominated by several species growing together.

Fremont's forests provide us with wood and food products, wildlife, scenic beauty, a modified microclimate, stabilization of steep slopes and snowpacks, the control of water flows, the creation and maintenance of stream habitat for aquatic animals, and recreation. In addition, forests constitute a major storage of carbon not only in the trees themselves, but in the forest soils as well. Most importantly, forests provide us with biodiversity. For these reasons, the Conservation Commission identified the Oak Ridge and Glen Oakes forests as key parcels to preserve.

NH is the second most forested state in the US trailing Maine. Fremont is approximately 70% forested; the state average is approximately 85%.[2] Many of Fremont's forests have grown from abandoned agricultural land and are now mature. However, due to increased development, the area of Fremont's forests is decreasing.

The Oak Ridge Town Forest in Fremont encompasses approximately 173.4 acres, with wetlands accounting for a substantial area and bisecting the property into north and south sections. The Forest includes land identified on Fremont's tax maps as 4-4, 4-8, 4-9, 4-10, 4-11, 4-12, and 4-16. A forest improvement harvest was conducted in January 1995 on 40 acres in the northern section. Biomass harvesting was used to carefully remove poor quality trees and provide growing space for a healthy stand of red oak and white pine. The Conservation Commission walked through this section in 2005 and encountered a scenic, fast-growing forest. Approximately 25 acres of the southern section was thinned for improvement in late 2005. The thinning provided growing space and light for healthy, valuable trees. Improving habitat for wildlife were goals for the activity in both sections of the forest. Consulting forester Charles Moreno has advised the Conservation Commission that the northern section of the forest will be ready for a follow-up thinning within the next 5 years. Moreno suggests the southern section receive a thinning in twelve years.

Glen Oakes is a 338 acre parcel of wooded land located on the southeast edge of Spruce Swamp. This land is essential to the protection of Spruce Swamp and has been earmarked by the Society for the Protection of New Hampshire Forests (SPNHF) and the Fremont Conservation

[2] NH Division of Forest and Lands

Commission as a top priority. The land lies between Copp Drive, Andreski Drive and Gristmill Road in Fremont.

Glen Oakes is an upland buffer that borders Spruce Swamp, the largest wetland in Rockingham County and designed prime by the Town of Fremont. According to SPNHF, 89 acres of the 338 appear in the USGS wetland survey. The remaining 249 acres are suitable for development. Glen Oakes and Spruce Swamp are within a 2,200 acre block of wetland forest, not all of which has been protected. Consulting forester Charles Moreno is currently developing a management plan for Glen Oakes.

There are seven tree farms in Fremont enrolled in the national American Tree Farm System® (ATFS), a program of the American Forest Foundation. Much of the work ATFS accomplishes is at the state and local level. ATFS programs are run by state and community volunteers. While each state Tree Farm program is self governing, all work under the guidelines developed at the national level.

Table 4. Registered Tree Farms in Fremont

Tree Farm	Approximate Acres	Location
Lyford	28	Shirkin Woods
Ladd	70	Copp Drive
Ragonese	41	Off Sandown Road
Sloan	66	Off Route 107, Raymond line, south of the Exeter River
Anderson	18	Old Ridge Road
Horsburgh	354	Beede Hill Road
Lawrence	183	Pillsbury Lane

4.7 Wetlands

See appendix "A" for Wetlands Map

Wetlands, as defined by the Environmental Protection Agency, the NH Department of Environmental Services and the Fremont Zoning Ordinance are those areas that are inundated or saturated by surface or groundwaters at a frequency and duration sufficient to support and that under normal circumstances do support a prevalence of vegetation adapted for life in saturated soil conditions. Thus a wetland is defined by the three "H's": hydrophytes or wetland vegetation, hydrology and hydric soils.

Wetlands are an integral part of Fremont's natural resources. They are important for removing excess nutrients and sediment from the water, slowing and storing floodwaters, promoting groundwater infiltration, and providing habitat for a variety of vegetation and animal life. In addition, wetlands provide recreational, educational and research opportunities. They add to the visual resources of the Town, especially in the fall when the red maples turn scarlet. Wetlands

are most often found along streams and adjacent to ponds and lakes. They can be found in clustered complexes that are of great value. Vernal pools are a special type of wetland that dry out completely in the summer and have no fish population. They are especially valuable for amphibian reproduction, but have not been mapped for Fremont. Please see page 17 of this report for more information on vernal pools.

There is a diversity of wetland types in Fremont, including areas of open water with emergent vegetation such as cattails, forested wetlands, and scrub-shrub wetlands. The principal types of wetlands with standing water in the spring have been mapped from aerial photos by the National Wetlands Inventory (NWI) of the U.S. Fish and Wildlife Service. The NWI wetlands do not include all wetlands, particularly those that do not typically have standing water in the spring. Therefore, this is an underestimate of the amount of wetlands.

The areas and number of each wetland type in Fremont are shown below in Table 5. The wetlands count does not reflect separate wetlands, but patches of wetlands classified as a particular type.

Palustrine wetlands are inland wetland systems which lack flowing water. Lacustrine wetlands are associated with lakes and ponds. Riverine wetlands are fed by water flowing through a channel.

Table 5 National Wetland Inventory in Fremont

Wetland Type	Acres
Upland	8812
Forested	1446
Scrub shrub	496
Emergent (e.g. cattails)	273
Palustrine	62
Lacustrine	52
Riverine	1
Total	**11142**

A comparative study of the functions and values of all the different wetlands in Fremont will be completed in 2007. Such an analysis is necessary to prioritize significant wetlands in the Town and to provide the data necessary to designate some wetlands as Prime under RSA 482-A: 15. These wetlands, when designated as such, receive special consideration from the Wetlands Bureau of NHDES. When a wetland is designated as Prime by a community, it is recognized as a valued natural resource, and protected as such.

Although all prime wetlands have not yet been identified, a great deal of research has been done on wetlands in Fremont, most notably by West Environmental in 2003, the Audubon Society of New Hampshire in 1998, and ongoing work by the Fremont Conservation Commission. This work has revealed there are 55 wetland complexes in Fremont that are two acres in size or greater. West Environmental is researching these wetlands and a final report is expected in late 2007.

Table 6 Fremont's Largest Wetlands and Wetland Complexes

Name	Location
Spruce Swamp	North Road at RR tracks; Copp Road
Spruce Swamp South	North and south of Rt. 107, Louise Road
Shirking Woods	South of Chester road, near Danville border
Tilton Swamp	West of Sandown Road

Spruce Swamp

Spruce Swamp is the largest wetland complex in Rockingham County and is identified as an Exemplary Fen by the New Hampshire Natural Heritage Inventory. A fen is a nutrient-poor basin swamp that is very sensitive to changes in water chemistry caused by adjacent land use. This wetland encompasses 827 acres, 711 acres of which have been designated Prime Wetlands. The Swamp is over two miles long from north to south and one and half miles wide from east to west. Spruce Swamp is drained by four streams, two flowing north towards the Piscassic River, and one flowing east and one flowing south, both towards the Exeter River. The swamp is located over a large aquifer and has a diverse plant community, including vast area of scrub-shrub, forested marshes, and large shallow marshes. Beaver impoundments control significant portions of this wetland systems hydrology. Wetlands ecologists consider Spruce Swamp to be one of the few remaining unspoiled ecosystems in southeastern New Hampshire.

In 2003, West Environmental conducted the first phase of the Prime Wetland study by evaluating the 711 acre Spruce Swamp. The evaluation was based on physical characteristics analyzed from existing data, such as soil type, topography, and watershed position, and on data collected in the field, such as plant communities, wildlife observed, etc. Wetland functions and values identified by West Environmental include:

- Groundwater Recharge/Discharge
- Flood flow Alteration
- Sediment/Toxicant/Pathogen Attenuation
- Nutrient Removal
- Production Export
- Sediment/Shoreline Stabilization
- Wildlife Habitat
- Recreation Value
- Education/Science
- Uniqueness

The study by West Environmental concludes Spruce Swamp "clearly qualifies for Prime Wetland designation."

In 1998, the Audubon Society of New Hampshire (ASNH) conducted a wetlands inventory for the entire Exeter River watershed. Wetland systems in the ten watershed communities were studied and two systems in Fremont were identified as priority wetlands in the watershed. These systems were labeled Spruce Swamp and Spruce Swamp South. These two priority wetland systems identified by ASNH were evaluated simply for descriptive purposes rather than for

comparative analysis using a methodology developed by the Army Corps of Engineers. The methodology describes twelve wetland functions: groundwater recharge/discharge; floodflow alteration; fish/shellfish habitat; sediment /toxicant/pathogen retention; nutrient removal; production export (produce food for or usable product for consumption); sediment/shoreline stabilization; wildlife habitat; recreation; educational/scientific; uniqueness/heritage; and, visual quality/aesthetics.

Below, is a summary of ASNH's findings for each system:

Spruce Swamp – This 827 acre wetland is primarily forested, with several areas of shrub swamp, emergent marsh, and ponded open water. Spruce Swamp drains into the Exeter River via a small tributary channel that originates in the wetland, known as Red Brook. Several large areas of marsh are highly interspersed with open water. The main area of the wetland comprises a mixture of primarily deciduous and some coniferous forested vegetation. Both the northern and southern extremes of the wetland include large areas of emergent marsh vegetation. Emergent sections are comprised primarily of bluejoint grass with some sedges. The edges are fringed with shrubs such as sweet pepperbush, leatherleaf, highbush blueberry, and mountain holly. Sphagnum moss dominates the shrub wetland floor. In the northern sections, especially west of the railroad trail, leatherleaf dominates the flooded shrub swamps. The habitat is utilized by a variety of songbirds. Beaver activity is evident in the form of lodges and dams in the southern emergent swamp section. The hydrologic regime is primarily flooded (shallow and deeper ponding) in the shrub and emergent areas, with saturated soils and some seasonal flooding in the forested sections. Disturbance in this wetland is primarily the railroad trail and several road crossing in the southern sections. Much of the value of this system lies in its large extent and diversity of wetland classes.

Spruce Swamp South – This 141 acres primarily emergent wetland is located immediately south of Spruce Swamp, north of Route 107. The wetland is characterized by a large cattail marsh and open water. South of Route 107, the wetland is dominated by forested and scrub swamp, areas of emergent marsh, and emergent-shrub wetland. The emergent and shrub sections are dominated by bluejoint grass, reed canary grass, sedges, alder, winterberry, northern arrowwood, silky dogwood, and red maple shrubs. There is good interspersion of vegetation and open water in these sections. Scrub-shrub and forested wetland vegetation includes cinnamon, royal, and sensitive ferns, swamp rose, witch hazel, alder, highbush blueberry, silky dogwood, buttonbush, red maple tress and shrubs, and scattered white pine and eastern hemlock. The hydrologic regime is permanently flooded north of Route 107. South of Route 107, the hydrologic regime varies from flooded to surface saturated in the emergent and scrub sections. This wetland is relatively small, but is important in the context of water quality and its location on the Exeter River. Its proximity (and possible connection) with Spruce Swamp further enhance the functions of this wetland.

Shoreland and Wetland Buffers

In addition to retaining the wetland itself, the undeveloped uplands surrounding the wetland are also essential for a healthy wetland. Maintaining a buffer of a naturally vegetated upland area adjacent to wetlands and surface waters is important to reduce the adverse effects of human activity on these water resources. Vegetation in buffers intercepts rainfall, slows meltwater and promotes infiltration. In addition, a vegetated buffer provides habitat for species dependant on the wetland system and travel corridors for larger mammals. A minimum upland buffer width around wetlands and other shorelines of 100 feet is recommended and 300 feet is desirable to maintain good habitat.[3]

Shorelines of lakes, ponds, rivers and streams are called riparian areas, corridors, or buffers. Wider, forested buffers along these areas are more effective than narrow, grassy ones according to *Introduction to Riparian Buffers*; Connecticut River Joint Commission for NH and VT, September 2000. This same report offers the following buffer requirements as seen in Table 7.

Table 7 Riparian Buffer Requirements

Function	**Buffer Width, Feet**
Stabilize banks	35' – 50'
Filter sediment to protect water quality	35' if slopes less than 15%
Filter dissolved nutrients & pesticides to protect water quality	100' to 500'. 100 feet removes about 60% of pollutants.
Protect fisheries	At least 100'
Protect wildlife	300' minimum
Flood control	Varies with size

It is important to note that the buffer should be wider if the adjacent land is sloped, if the land use is intensive, if the soils are erodible, if the land is a floodplain and if the stream or river naturally meanders. Buffers benefit water quality and wildlife by providing habitat, filtering pollutants from runoff, promoting groundwater infiltration, and stabilizing stream banks to control erosion.

The first step to protecting wetlands and the functions they provide is protecting the land surrounding them. A look at current zoning regulations in Fremont shows a limited amount of protection to buffers compared to recommendations from "Buffers for Wetlands and Surface Waters", A Guidebook for New Hampshire Municipalities published in 1997 by the NH Department of Environmental Services. The guidebook states that "100 feet is recommended as a reasonable minimum buffer width under most circumstances." It explains that research has shown that 100 feet will generally provide a 60% or higher removal rate of pollutants. Because of the impacts to human health of tainted water supplies, buffers larger than 100 feet may be prescribed around existing or potential water supplies. Buffers of 100 feet protect wildlife species that are aquatic or that stay very close to the wetland edge, but would provide little or no life support for others. Water quality in wetlands and surface waters is important for all wildlife, not just aquatic.

[3] Chase, Victoria, Buffers for Wetlands and Surface Waters, Office of State Planning, Audubon Society of New Hampshire, UNH Cooperative Extension, 1995, revised 1997.

Current Fremont zoning regulations require a 100 foot buffer between septic systems and wetland soils and a 100 foot buffer between wells and wetland soils. Buildings currently have a setback of 100 feet from wetland soils. Septic systems, which generate excess nutrients and pathogens, are not at the minimum recommended setback and are potentially very detrimental to wetland systems. Septic systems have a finite useful life until replacement is needed; unfortunately replacement is seldom done until the system fails. Hydric B wetlands are usually a waterbody's first defense against pollutants. Hydric B wetlands need just as much buffer as Hydric A soils to provide an acceptable rate (60%) of pollutant removal. Buffering wetlands and surface waters should make up only one piece of a comprehensive natural resource protection plan. As the town faces more development pressures on natural resources, changes in zoning may need to be instituted, coupled with protection through acquisition or easements, to protect a broad spectrum of water resources.

Fremont has also adopted a Watershed Protection Ordinance which increases buffer requirements to 150 feet along the Exeter River, Piscassic River, Loon Pond, Red Brook, Brown Brook and other named streams. Loon Pond is the only waterbody in Fremont protected by the State of New Hampshire's Comprehensive Shoreland Protection Act. The Act requires a 250 feet setback from rivers 4th order and above and lakes and ponds greater than 10 acres in size.

4.8 Surface Water Resources

See appendix "A" for Water Resources Map

Fremont's water resources consist of a hydrologically connected system of rivers, streams, brooks, small ponds, wetlands, and groundwater. Fremont's surface and groundwaters are intricately interconnected. In some locations and under some conditions, the surface waters recharge the groundwater and in other locations and conditions, the groundwaters feed our rivers, ponds, wetlands and streams and keep surface waters flowing even during droughts. The quality and quantity of one can significantly affect the other.

Our water resources are vital for habitat for plants and animals. Undeveloped shoreline areas are essential for almost all wildlife species during some portion of their life cycle. Fremont residents rely upon clean groundwater from private wells. These rivers, streams and ponds, and the quality of their waters and shoreline, are very important to the quality of life for residents and visitors. Fishing, canoeing and swimming in Fremont's waters are popular activities.

Fremont's Watersheds

A watershed is the land which water runs over, across or under on its way to the lowest point, or basin, usually a river or stream. A watershed stores and sheds (run-off) water, and watershed are nested and connected by the water flowing through them. How people use land within a watershed determines the quality of the water in the lakes, streams, wetlands, and groundwater below. Fremont lies within two watersheds, the Exeter River watershed and the Piscassic River watershed.

1. Exeter River Watershed—The Exeter River flows from west to east across the southern portion of Fremont and serves as the primary public water source for the town of Exeter. The watershed encompasses ten communities, Chester, Danville, Sandown, Raymond, Fremont, Fremont, Kingston, East Kingston, Kensington, and Exeter. The river flows over the Great Dam

in downtown Exeter, and becomes the tidal Squamscott River, a primary tributary to Great Bay. The watershed encompasses 8,155 acres, or 73%, of town. Some of the fastest growing communities in New Hampshire are located in the Exeter River watershed, creating a challenge for communities trying to balance growth and development with protection of drinking water supplies and natural resources.

The Exeter River Local Advisory Committee (ERLAC) was formed in 1996, and developed a management plan for the watershed in 1999. ERLAC partners with watershed communities to advocate for stewardship of the river's natural state. Currently, ERLAC is partnering with the NH Department of Environmental Services to complete a vulnerability analysis for the Exeter River watershed. The analysis will be completed in 2008 and will identify areas in the watershed most impacted by development. For additional information, they may be contacted at 156 Water Street, Exeter, NH 03833. ERLAC maintains a website at www.exeterriver.org.

2. Piscassic River Watershed—The Piscassic River flows from west to east across the northern most portion of Fremont and on into Brentwood. The Piscassic watershed covers approximately 2,984 acres, or 27%, of Town.

Table 8 Fremont's Named Rivers, Streams and Brooks

Watershed	**River/Stream**
Exeter River	Exeter River
Exeter River	Red Brook
Exeter River	Little River
Exeter River	Abigail Brook
Exeter River	Great Brook
Exeter River	Horse Brook
Exeter River	Huchen Brook
Exeter River	Jewell's Brook
Exeter River	Loverings Brook
Exeter River	Maple Glen Brook
Exeter River	Moody Brook
Exeter River	North Meadow Brook
Piscassic River	Davis Brook
Piscassic River	Piscassic River
Piscassic River	Brown Brook Squires Spring Winding Brook Woodman Causeway

There are over 17 intermittent streams located within the Town of Fremont. Most of them are unnamed, flow seasonally, and are located in areas with poorly and very poorly drained soils.

Numerous aquatic species call these rivers and streams home. The water courses and their adjacent riparian corridors are important habitat and travel corridors for most of Fremont's terrestrial wildlife. In addition, many bird species are attracted by the water and the food sources that are located nearby.

The quality of water and habitat in rivers and streams depends upon surrounding land uses and management practices. Sediment from erosion destroys spawning habitat and fills stream beds. Removal of streamside vegetation raises water temperatures and can destroy habitat for trout and many other species upon which fish depend.

Development pressure is increasing along Fremont's rivers and streams. There are no significant human withdrawals of water from Fremont's streams or rivers. However, as development pressures mount, streamsides and stream integrity will be threatened.

Vernal Pools

Little is known about the number and location of vernal pools in Fremont. Given their importance for maintaining biodiversity, this is unfortunate. One of the problems is that vernal pools are not easy to identify for most of us and people need to know what to look for. Although vernal pools may vary in size from a few square feet in area to over a number of acres and may be located in a number of different sites – woods, floodplains or gravel pits—they do have certain features in common. Although they appear in the same place year after year they are defined as a temporary bodies of water because most dry up in hot weather or times of drought. All of them are contained bodies of water without any permanent outflow.[4] They do not support fish and are therefore excellent breeding grounds for species whose eggs would provide an excellent food source were fish present. Some species are so dependent on vernal pools for their survival that their very presence is taken to establish that a particular basin of water is indeed a vernal pool. Not surprisingly, these are known as indicator species.

An essential inhabitant of vernal pools is the fairy shrimp. These are tiny crustaceans that are found throughout the country. They are the earliest creatures to be seen in the spring, often appearing in March when their early mating leaves eggs on the floor of the pool. These are designed to survive drying out, intense heat, freezing, and even being eaten by birds and, despite everything, will hatch the following spring when the pool is once again filled with water. Should there be a dry spell that prevents this from occurring, the eggs are prepared to wait out the weather.

Some amphibians are also indicator species of vernal pools. Indicator species in New Hampshire are the spotted salamander and the wood frog. Wood frogs are one of the earliest creatures to be seen in the spring, often appearing in March, when their early mating makes it possible for the eggs to develop before the pool dries up. The wood frog call sounds very much like the quacking of ducks and is an early sign of spring. This frog is brown with a black mask, and is often seen in the woods during the summer.

[4] Information for this segment of the Natural Resource Inventory comes from *Identification and Documentation of Vernal Pools in New Hampshire*, ed. Anne Tappan (New Hampshire Fish and Game Department Nongame and Endangered Wildlife Program, 1997).

Spotted salamanders lay their eggs in vernal pools as well and migrations of salamanders to breeding areas usually take place after the first heavy rain in early spring. Although both the spotted salamander and the wood frog may be found mating in more permanent waters, eggs laid in vernal pools have the best chance of surviving. The spotted salamander will often lay her eggs in October and, if the pool is still dry, will stay with them keeping guard until Fall rains arrive.

Many other species use vernal pools although they do not have the same dependency upon them. Among the amphibians the species are four-toed salamander, Eastern newt, spring peeper, American toad, the gray treefrog, and the green frog. Among the invertebrates, there are clam shrimp, fingernail clams, and amphibious snails, caddis flies and other aquatic insects. Although no reptile is among the indicator species, the spotted turtle, the earliest turtle to appear in the spring, sometimes moving about in March, often uses such pools as a source of food and a place for courtship and mating. Blanding's turtles have been known to overwinter in vernal pools. Both of these species are endangered in New Hampshire and their appearance is of special interest to the Non-Game and Endangered Species Division of New Hampshire Fish & Game. In fact, if you think you may have a vernal pool on your property, it is possible to obtain a documentation form from Fish & Game and they would welcome a report on the sighting of any of the reptiles or amphibians mentioned here. Such reports may also be given to the Audubon Society of New Hampshire.
If you think you have a vernal pool on your property try to identify it while causing as little disturbance as possible. Research has shown a vernal pool may require 30 acres of undisturbed upland to thrive. A trip to the pool at night should enable you to hear the wood frogs quacking in early spring. Following a spotted salamander migration will eventually lead you to such a pool. Daytime exploration would consist of finding the eggs of these amphibians. Wood frog eggs lack a surrounding gelatinous capsule and do not look as though they are holding a consolidated shape. They are attached to twigs just below the surface of the pond. Salamander eggs are surrounded by a firm jelly-like substance with individual eggs visible inside. The egg mass is attached to sticks, grass, weeds or reeds usually eight to ten inches below the surface. The upper part of the egg is dark brown or gray and the lower part dirty white or dull yellow. Adults of these species may also be seen. It is, of course, essential to disturb the animals as little as possible in your effort to identify a vernal pool. In reporting such findings to the Nongame and Endangered Wildlife Program at 2 Hazen Drive in Concord (603-271-2462) photographs of the site would be enormously helpful.

4.9 Groundwater Resources

See appendix "A" for Groundwater Resources Map

Water in the saturated zone (below the water table) under the surface of the earth is called groundwater. It starts as rain and snowmelt, which then seeps down from the surface and saturates materials such as soil, sand, gravel and rock below the water table. Like surface waters, groundwater moves, although more slowly. As with surface water, the movement of groundwater is driven by gravity, which creates hydraulic head or water pressure. Groundwater moves from areas of high head to areas of low head. Pumping wells create areas of low hydraulic head, causing groundwater to move from the surrounding area toward the well. In general, the greater the amount of water being pumped from a well, the greater the area of land that contributes water to the well. The wellhead protection area is an approximation of the contributing area. Groundwater and surface water are interconnected. Depending on the site, the

time of year, the weather, and nearby withdrawals and discharges, groundwater may discharge to surface water or vice versa.

All of Fremont's residents rely upon groundwater for their drinking water with wells drilled into underlying sand and gravel deposits. The U.S. Geologic Survey has characterized Fremont as having two types of stratified drift aquifers, labeled as "Stratified-Drift Aquifer" and "Stratified-Drift Aquifer Over Glacial-Estuarine Silt and Clays". The boundaries of the primary recharge areas for these aquifers are depicted on Map X, Groundwater Resources Map.

An aquifer can be defined as a formation, group of formations, or part of a formation that contains sufficient saturated, permeable material to yield significant quantities of water to wells and springs. There are bedrock aquifers and sand and gravel aquifers with the latter being the most productive. A small portion of the town consists of sand and gravel aquifers. These are glacial deposits of sand and gravel that hold significant amounts of water in the pore spaces between the particles of sand and gravel. This groundwater is continuously replenished by rain and other surface waters.

Groundwater is vulnerable to contamination, most often from leaking underground storage tanks, poorly maintained septic systems, improper disposal of hazardous chemicals, or vehicle accidents. Gravel pits are often located in or over aquifers. Land over aquifers tends to be favored for development because it is relatively level and easily excavated. The identification and careful monitoring of land uses near aquifers is important. The Town of Fremont has adopted an Aquifer Protection Ordinance that requires lot sizes to be a minimum of three acres and no more than 10% impervious surface (buildings, driveways, etc.) coverage on the lot. The Ordinance also prohibits certain activities, such as auto repair and hazardous waste storage, to protect the underlying aquifer.

The ability of an aquifer to supply water is called transmissivity and is measured in ft^2/day. All of the aquifers in Fremont have a transmissivity of less than 1000 ft^2/day or less and are not considered adequate for a public water supply.

Aquifer recharge is the process by which rainwater and snowmelt seep down through the soil into an underlying aquifer. Many natural processes determine how much of the water actually reaches the aquifer and how much evaporates, is consumed by plants and animals or runs off the ground surface into surface water bodies. Much attention has been directed to the importance of protecting surface waters and wetlands from filling and contamination, but there has been much less effort directed towards protecting critical aquifer recharge areas. These are areas where contamination would directly impact potable water supplies in the aquifer. In addition to eliminating contamination sources, water must be allowed to seep into the ground in order to protect both the quality and the quantity of water in an aquifer. Requiring new development to retain all stormwater and melt water on site will help to maintain pre-development levels of recharge. A useful publication in this regard is *Managing Stormwater as a Valuable Resource,* published by the NH Department of Environmental Services in 2001.

Drinking Water

The majority of drinking water supplies in Fremont are from bedrock wells ranging in depth from 145' to 550' below ground surface. According to NH Department of Environmental Services as of February 2007, Fremont has nine active public drinking water supplies: Barnyard Buddies Day Care, Colonial Poplin Nursing Home, Country Club for Kids Day Care, Ellis School, Fremont Learning Environment Day Care, Fremont Pizzeria Restaurant, Governor's Forest senior housing, Poplin Café, and United Machine and Tool.

NH Department of Environmental Services has prepared a Drinking Water Source Assessment Report for Fremont. This report assesses the vulnerability of each public water system to contamination. For more information on Best Management Practices (BMPs) to protect drinking water supplies, the NH Department of Environmental Services has three useful fact sheets, *Protecting Groundwater Resources, Municipalities Have a Key Role in Protecting Groundwater Resources* and *Protecting Public Drinking Water Sources Based on Source Assessment Reports* can be found at the NH DES website, www.des.state.nh.us.

Contamination Sources

Groundwater quality can be impaired by a variety of materials. Sources of groundwater contaminants include landfills, commercial and industrial wastes, agricultural fertilizers, human sewage, and road salt. NH DES has mapped known and potential contamination sites as part of a groundwater hazards inventory. The inventory is a list of sites registered with NHDES which may be known or potential threats to groundwater. The known sites are locations where contamination of the soil or groundwater has occurred and has been cleaned up or is being monitored by NH DES. A complete listing of these sites can be found at the NH DES website, www.des.state.nh.us.

Impervious Surfaces

When a watershed is increasingly covered with pavement, buildings, and other compacted surfaces that are impervious to water, significant changes in water quality and quantity result. When rain falls on impervious surfaces, it runs off faster into surface waters, carrying with it sediment and pollutants from road surfaces, lawns, construction sites, and parking lots. Flooding, warming, and channelization of streams results. Infiltration of rainfall into the ground to replenish groundwater is reduced, impacting the quantity of groundwater available for withdrawals for drinking water.

This type of run-off, called "non-point source pollution" is now the most serious threat to water quality for New Hampshire and for Fremont. Construction and site designs that promote retention and infiltration of rainwater and runoff, narrower streets and driveways when possible, shrub and tree buffers to waterways, and more compact development patterns can protect Fremont's water quality and quantity as the town grows.

Studies conducted in the northeast have documented that by converting as little as 10% of a watershed to impervious surfaces, stream water quality and organisms begin to deteriorate. Above 25% impervious surface, water quality is seriously degraded. On-going research by the NH Coastal Program and US Geologic Survey in the Exeter River watershed has documented the effects of urbanization on stream quality. Results to date from this study indicate that the percent

of urban land use in riparian buffer zones and the percent of impervious surface in a watershed can be used as indicators of stream quality. Sites studied along the Exeter River with greater than 14% impervious surface generally showed changes in water quality and habitat conditions.

The NH Estuaries Project and UNH Complex Systems Research Center studied the degree of impervious surface cover in the coastal watersheds over the period 1990 - 2005. These analyses showed that the average impervious surface cover in Fremont was 3% in 1990, 4.9% in 2000, and 5.9% in 2005. The number of miles of road in Fremont was also analyzed during the same time period for Class I, II, III, IV, and V roads. Road miles in Fremont in 1990 were 29.13, 32.17 in 2000, and 36.61 in 2005. The objective of this indicator is to estimate the rate of low-density residential development in towns.

4.10 Wildlife Habitat

See appendix "A" for Wildlife Habitat Features Map

The Wildlife Habitat Features Map shows data compiled by GRANIT, RPC and NH Fish and Game. The map displays several kinds of land use (i.e., disturbed, cleared, and conservation land), specific habitat types (i.e., riparian buffers, south facing slopes, and wetland clusters), and surface waters. A major concern for wildlife is that haphazard patterns of development of the landscape have caused habitat fragmentation. Wildlife that are sensitive to human encroachment are restricted to islands of undisturbed land, and may die out of the area is too small. Fragmentation also creates barriers to the movement of many terrestrial species. Wildlife corridors are tracts of undeveloped land that provide linkages between significant habitat areas. Travel ways and migratory routes are often located along streams and rivers. Linkage corridors can be virtually any type of traversable land of at least 200 feet in width that provide avenues for wildlife movement and discourage the creation of habitat islands.

4.11 NH Fish and Game Wildlife Action Plan

The NH Fish and Game Department released the state's first comprehensive study of wildlife in 2006. The *Wildlife Action Plan (WAP)* addresses the protection and restoration of species in greatest need of conservation, and addresses the needs of the full array of wildlife in New Hampshire. The WAP identifies the different types of wildlife habitat found in Fremont and ranks the habitat on four different levels. The top level, Tier 1, is the highest quality habitat in the entire state of New Hampshire. Fremont has 1,093 acres of Tier 1 habitat, 23 acres of which is protected from Development. Tier 2 is the highest quality habitat in a specific biological region, such as a watershed. Fremont has 790 acres of Tier 2 habitat and 21 acres are protected. Tier 3 habitat is significant habitat at the regional scale. Fremont has 2,558 acres of Tier 3 habitat, with 114 acres protected. Tier 4 habitat is locally significant habitat and Fremont has 3,960 acres of Tier 4 habitat and 39 acres are conserved.

Table 9 Land Cover – NH Fish and Game Wildlife Action Plan

Land Cover	Acreage	Acres Conserved	Percentage Conserved
Appalachian oak-pine	4098	128	3.1
Hemlock-hardwood pine	4107	68	1.7
Grasslands	509	3	.7
Floodplain forest	715	16	2.2
Wet meadow/shrub wetland	850	55	6.7
Peatland	578	13	2.3
TOTAL	10,857	283	

The NH Natural Heritage Bureau's database lists one species of concern in Fremont, Carex seorsa, or Separated Sedge, an endangered species found in Spruce Swamp. It should be noted that many species could be added to a list of species of concern if their habitat continues to be diminished. An extensive and detailed wildlife inventory should be completed for Fremont.

The Bureau also lists Fremont's floodplain forest, marsh and peatland as significant wildlife habitats, and a medium level fen system as an exemplary natural community. A fen is a type of wetland fed by alkaline, mineral-rich groundwater and characterized by a distinctive flora. Fens are often confused with bogs, which are fed primarily by rainwater and often inhabited by sphagnum moss, making them acidic. Like other wetlands, fens will ultimately fill in and become a terrestrial community such as a woodland through the process of ecological succession.

4.12 Fisheries

Fishing is a popular hobby and Fremont's fisheries are an important natural resource. New Hampshire Fish and Game stocks fish in both the Exeter and Piscassic Rivers in Fremont from mid-March to early-July.

4.13 Beneficial Insects

Beneficial insects are a natural way to fight insect pests and protect our environment. When we encourage beneficial insects we are increasing our biodiversity and decreasing our dependency on poisonous chemical controls. Not only are we creating a more beautiful environment, but a safer one as well.

There are two categories of insects considered beneficial, predators and parasites. Predators are organisms that kill and feed on their prey outright. They are generally larger than their prey and must eat lots of prey to complete their development. Parasites are usually smaller and often weaker than their prey. They lay eggs on or within a host insect. The immature larvae use the host for food over time. A parasite will use only one or a few insects for food.[5]

You can entice beneficials to your yard and garden by providing them with the three basic necessities: water, food and shelter. In addition, you should avoid using and/or spraying broad-spectrum insecticides. The broad-spectrum insecticides are not selective in that they will kill not only the pest but the beneficial as well. Even the organic pesticides will kill the beneficials. A list of the more important beneficial insects we should encourage can be found in the Appendix.

4.14 Invasive Species

It is important that those of us who reside in Fremont be informed and aware of invasive species (plants, insects and fungal species) that have the potential to destroy and displace those natural resources that are vital to our biodiversity. According to the New England Wildflower Society, nearly 1/5th of New England's 3,000 plant species are in danger of disappearing from our region. In addition, invasive species are degrading public natural areas at an estimated rate of 4,600 acres per day. The Nature Conservancy estimates that 42% of all species on the Federal Endangered Species Lists are listed partly due to the effects of invasive species (and for 18%, invasive species are the sole reason for their listing).[6] According to the US Department of Agriculture website (www.usna.usda.gov/gardens/invasives.html), over $100 million dollars a year is spent in the United States combating invasive plants in wetlands alone. Rich, diverse plant communities can become barren, inhospitable expanses of invasive plants with little value to wildlife. Invasive plants may even deplete groundwater. The public must be educated to buy plants wisely and to control existing invasive plants. Additional information is available at Cooperative Extension offices.

An Invasive Species is a plant, insect, and/or fungal species that is not naturally native to a particular region and has the ability to thrive and spread aggressively outside its natural range. The Invasive Species thrives and spreads in a new habitat due to the fact it has no natural predators (insects, diseases and/or foraging animals) that naturally keep its growth under control as they would in their own native habitat.

Without any natural predators to prevent its spread, the invasive species, particularly in the case of plants, will put extreme pressure on native plants and animals. Ultimately the invasive plant will alter native habitats and reduce biodiversity by choking out native vegetation, threatening rare and endangered species and degrading wildlife habitat. With the loss of native vegetation and wildlife habitat also comes the loss of a number of our native animal, bird and insect species that depend on the native habitats to survive. Invasive species present the worst threat in wetlands, sand dunes, fire prone areas, and serpentine barrens where rare native plants are found.[7]

Invasive Plants

- Produce large numbers of new plants each season;
- Tolerate many soil types and weather conditions;
- Spread easily and efficiently, usually by wind, water , or animals;
- Grow rapidly, allowing them to displace slower growing planes;
- Spread rampantly when they are free of the natural checks and balances found in their native range[8].

[6] *Conservation Notes of the NE Wildflower Society*, Vol. 2, No. 3, 1998.
[7] United States National Arboretum.
[8] United States National Arboretum.

In 2000, the State of New Hampshire enacted legislation under House Bill 1258-FN which "requires the Commissioner of Agriculture, Markets, and Food to conduct research and educational activities which address the effects of invasive plant, insect and fungal species upon the state".[9] As a result of this legislation, the New Hampshire Invasive Species Committee was formed. A list of species prohibited and restricted in NH can be found in the Appendix.

4.15 Focus Areas in Fremont Identified in *The Land Conservation Plan for NH's Coastal Watersheds* Plan

The Land Conservation Plan for New Hampshire's Coastal Watersheds was released in July 2006 by The Nature Conservancy, Society for Protection of New Hampshire Forests, Rockingham Planning Commission and Strafford Regional Planning Commission. The Plan identifies areas that represent the best remaining opportunities to conserve the critical ecological, biological, and water resources of New Hampshire's coastal watersheds. Four principal resource analyses and maps were developed that capture key natural resources features: forest ecosystems, freshwater systems, irreplaceable coastal and estuarine resources, and critical plan and wildlife habitat. These maps were integrated into what is known as resource co-occurrence model. From the wealth of this data, 75 Conservation Focus Areas were identified in the 46 towns in the coastal watersheds. Fremont contains two of these Conservation Focus Areas, labeled as Spruce Swamp and Upper Exeter River. The features of these areas are described below:

Spruce Swamp Conservation Focus Area – This focus area is 1,850 acres in Fremont and contains a portion of a 670 acre unfragmented forest block, and a 1,700 acre unfragmented forest block identified as a Tier 2 priority in the Wildlife Action Plan. The area has aggregated forest block totaling 8,400 acres and 3.3 miles of 1st order river and streams. Separated Sedge, a plan of conservation concern in New Hampshire is in the Focus Area. Significant wildlife habitats include floodplain forest, marsh, and peatland. The Focus Area also has an Exemplary natural community – the fen system found in Spruce Swamp, and 6.2 acres of farmland of statewide importance.

Upper Exeter River Conservation Focus Area – This Focus Area is 3,010 acres and is located in Fremont, Chester, Danville, and Sandown. It contains a 740 acre unfragmented forest block, a portion of an 800 acre unfragmented forest block, a portion of a 2,110 acre unfragmented forest block, and a 1,300 acre block identified as a Tier 2 habitat in the Wildlife Action Plan. The Focus Area is located within a 24,700 acre aggregated forest block. The Area has 6.5 miles of 1st order river or stream, 1.9 miles of 2nd order, and 7.1 miles of 4th order. There is a Great Blue Heron rookery in the Focus Area, an animal of conservation concern. Vesper Sparrow is also found in the Focus Area, another animal of conservation concern. Significant wildlife habitat includes floodplain forest, grassland, marsh, peatland, and ridge/talus. The Area has 299.8 acres of high yield aquifer (maximum transmissivity > 1,000 sq. ft/day). There are 71.2 acres of prime farmland and 72.3 acres of farmland of statewide importance in this Focus Area.

4.16 NH Natural Services Network

The NH Natural Services Network is a component of the Rebuilding I-93 initiative being overseen by NH Department of Transportation. The Network is designed to help communities identify and maintain essential benefits provided by the natural environment for human needs,

[9] Final Version HB 1258-FN.

and to provide a regional context for land use development and design regulations. The network identifies water supply resources, flood storage areas, economically important soils, such as farmland and forest soils, and significant wildlife habitat. This information can be used by Fremont to help identify and prioritize land protection and regulate the location and density of development. The Natural Services Network maps are Maps #.

4.17 Regional Master Plan

The Rockingham Planning Commission (RPC) has written a Regional Master Plan for the twenty seven communities in the RPC region. This Plan has a Natural Resources chapter, which was drafted in June, 2007. The chapter identifies significant threats to natural resources in the region, discusses principles and policies for natural resource management, and recommends the chapter be adopted as part of a Town's Master Plan. Significant threats to natural resources in the region include fragmentation and sprawl, threats to water quality, threats to wildlife, and threats to the working landscape.

4.18 Open Roads, Open Space

Open Roads, Open Space is an initiative of the Society for Protection of NH Forests designed to assist the 26 communities, at their request, in planning for and securing permanent open space conservation in their towns. The initiative is a component of the NH Department of Transportation's Community Technical Assistance Program, being offered to the 26 municipalities impacted by the expansion of Interstate 93 between Salem and Manchester.

4.19 Scenic Resources

Scenic resources in Fremont were identified by the Conservation Commission as areas in town that offered views of a scenic, natural landscape. These areas are:

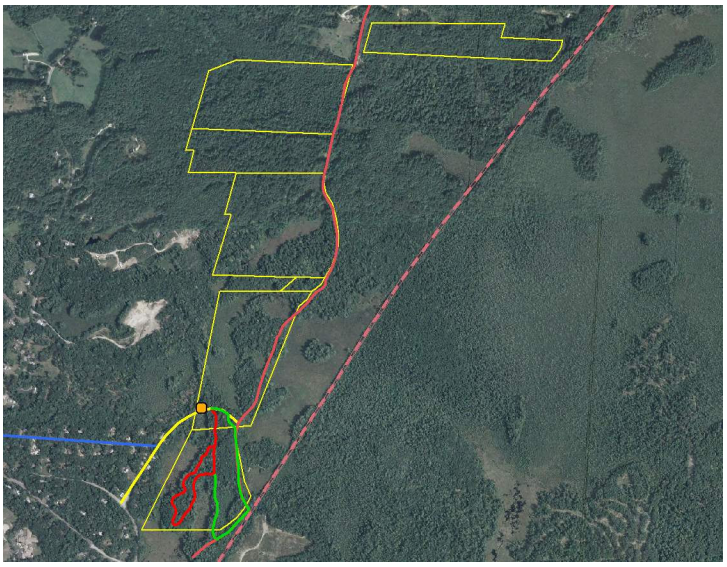
- Top of Beede Hill Road
- Scribner Road
- Peterson's Farm on Martin Road
- Exeter River at Sandown Road
- Exeter River at Turner's Dam on Scribner Road
- Clough's Bridge on Route 111A
- Glen Oaks

4.20 Historic Resources

The Historic Resources Map shows data compiled by GRANIT and the RPC. Data from the National Register of Historic Places are included on the GRANIT database. The locations of locally important historic sites were added by Fremont Conservation Commission. A comprehensive and invaluable history of the Town of Fremont was published in 2004 by Matthew Thomas.

4.21 Oak Ridge Town Forest

The Oak Ridge Town Forest is comprised of seven parcels: Tax Map 4 Lots 4, 8, 9, 10, 11, 12 and 16 for a total of 173.4 acres. Wetlands cover a substantial area of this property and naturally bisect the property into the "north" and "south" sections. Preferred access is from Meetinghouse Road. As you come to the end of Poplin Drive (next to the Post Office), Poplin intersects Meetinghouse Road. Turn left onto the gravel/dirt continuation of Meetinghouse Road.



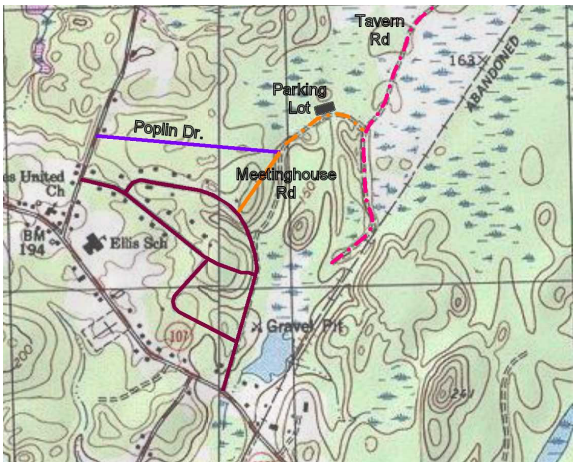
Approximate Boundaries of the Oak Ridge Town Forest

1. The intersection of Poplin Way and Meetinghouse Road

2. Sign at the Oak Ridge parking lot.

Keep to the left on the dirt road and proceed past the open area on the right, which is privately owned, to the newly constructed parking lot. The parking area is located about 737 feet from the Meetinghouse Road entrance. It's on the left, just past the sign marking the beginning of the Town owned area.

3. The sign marking the southern entrance to the Oak Ridge Conservation Area.



4. Map showing the location of the Oak Ridge Parking Lot.

5. View of Oak Ridge Parking Lot

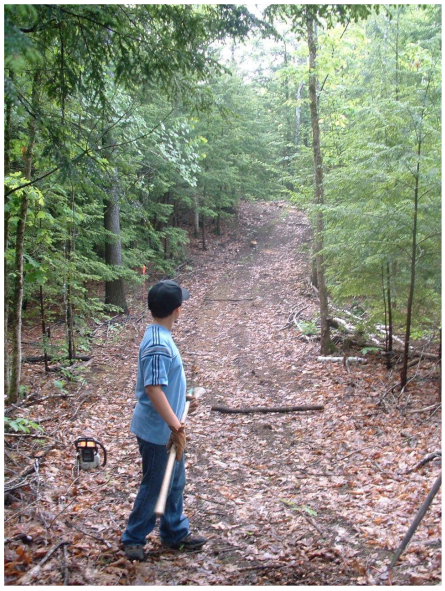
6. Parking is available for three cars.

This parking lot was constructed in 2006 by a group of volunteers, including the Fremont Boy Scouts and Cub Scouts, several members of the Fremont Conservation Commission and other interested Fremont residents at the log landing of the most recent timber harvest (2005). Please do not park on the privately owned lot at the Meetinghouse Road entrance.

After parking, there are several possible routes for an interesting walk with views of beautiful wetlands and intriguing landforms. The volunteers that constructed the parking lot also constructed a loop trail called the Marsh Trail using the skidder path as the connector. Another route that takes off from the connector trail entrance is the Ridge Trail. Both trails begin about 120 feet beyond the parking lot on the opposite side of the road. The trails entrance is marked with a sign.

7. The entrance to the Marsh Trail and the Ridge Trail

8. View of the mulched trail just beyond the entrance to the Marsh Trail and the Ridge Trail



9. Volunteer Scout admires the new trail.

10. A red eft climbing on lichens, viewed at Oak Ridge.

The Marsh Trail

The Marsh Trail loop begins about 550 feet from the trail entrance. It is about 3595 feet from the trail entrance, around the Marsh Trail loop and back to the trail entrance. This walk takes you on the edge of a beautiful, interesting marsh. You will see a beaver dam and possibly some interesting wildlife such as deer, turtles and waterfowl.

11. This sign marks the start of the Marsh Trail.

12. View of a beaver dam from the Marsh Trail

The Ridge Trail

The Ridge Trail provides a pleasant walk to the section of Tavern Road that runs parallel to the Rail Trail. At the intersection of the Ridge Trail and Tavern Road, make a left and walk north, to where the road bends to the left. If you continue straight on the path, proceeding beyond the bend, the path intersects with the Rail Trail. If you follow the bend in the road and continue on Tavern Road, you will be walking on the Tavern Road esker (see the section below titled "The Tavern Road Esker") and back to the entrance to the Oak Ridge Trails.

According to Matthew Thomas's book, it was common practice for the townspeople to dump their bottles and garbage down the side of the highest point on the esker into Spruce Swamp. Now that we know that Spruce Swamp is a rare ecological system, we are hoping that the townspeople will work together to remove the trash that remains on the hillside.

13. Scenic view from the Ridge Trail

14. View of trash that has been dumped over the side of the Tavern Road Esker.

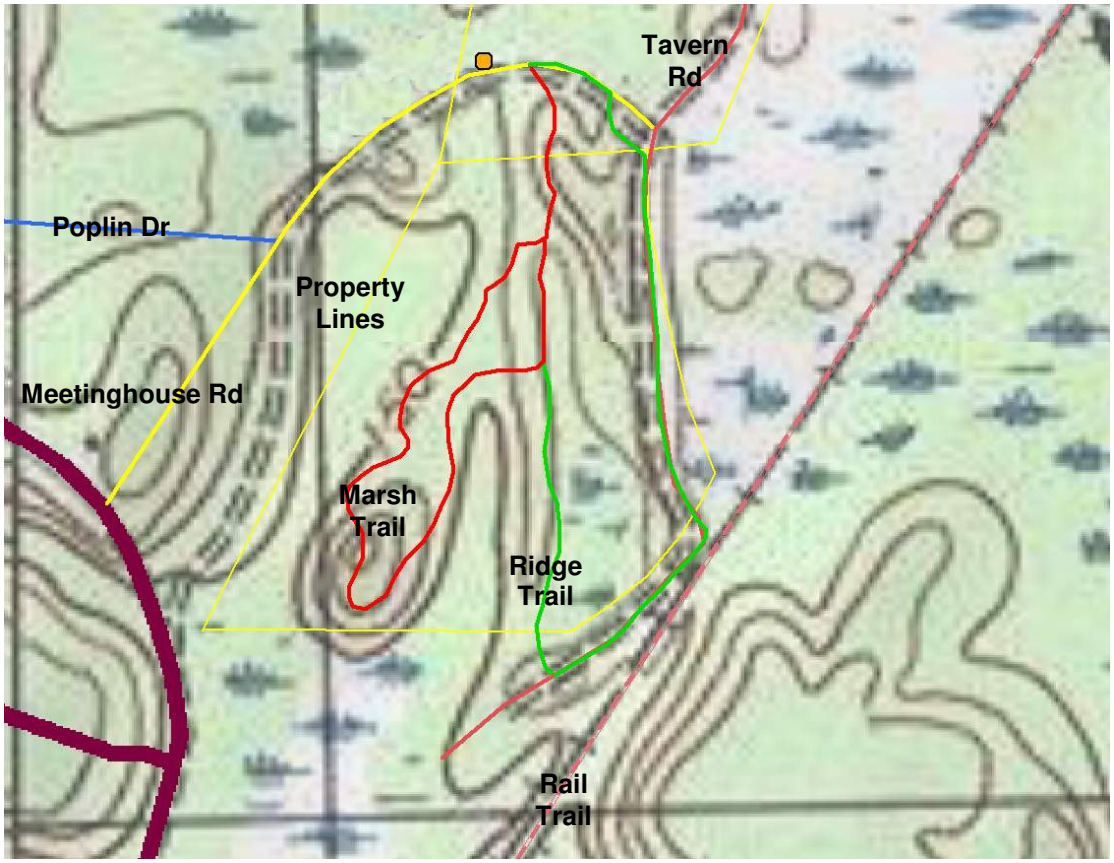
Alternatively, from the parking lot you can continue walking north on the dirt road (Meetinghouse) until it intersects Tavern Road. Tavern Road was formerly called Ridge Road and is still labeled as such on U.S.G.S. topographical maps. If you keep to the left at the Tavern Road fork, you may be able to walk north to the paved portion of Tavern Road during dry weather. The road passes through two large wetland areas and the road is sometimes covered with water. Going north, the Town property will be on your left, and property owned primarily

by Phillips Exeter Academy will be on your right. As you walk north on Tavern Road, you will pass through Fremont's prime wetland know as Spruce Swamp. See page 521 of Matthew Thomas's book History of Fremont, NH for a brief history of Tavern Road.

In his book, Matthew Thomas quotes the following enchanting paragraph from the August 14, 1891 edition of the *Exeter Gazette:*

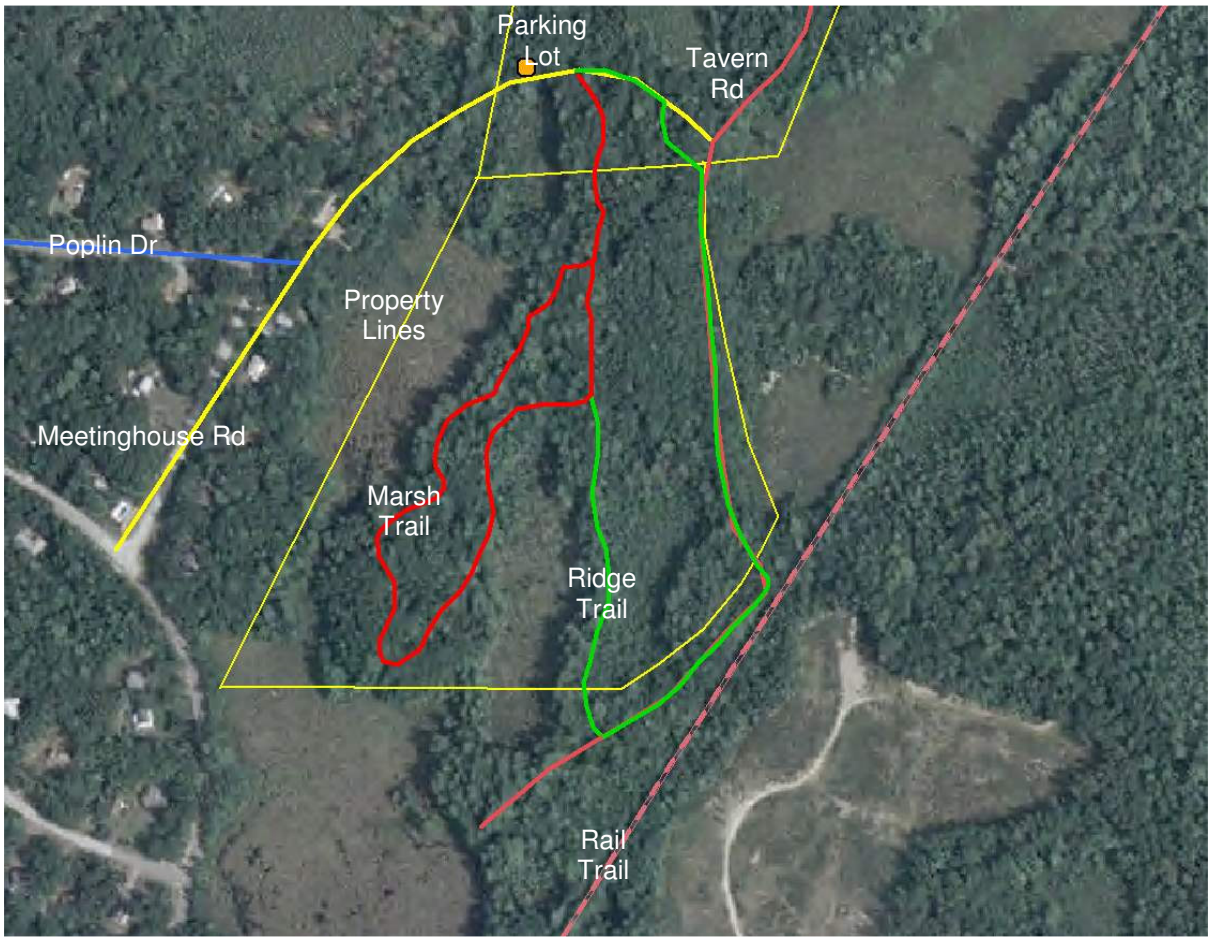
"Fremont – During the past two weeks our home has been in Spruce Swamp, truly, ***"The land of the free," if not "the home of the brave."*** *The blueberries hang in clusters on the bushes as big as grapes. For more than two miles in every direction the bushes are loaded with fruit. Under the clusters of spruce trees we eat our noontime lunch. Our feet are resting on the cold, moist moss, and the cool wind blows clear and fresh from the Island timber pines. We think of friends basking in the sea-side sands, under the glare of a burning sun, and plagued by swarms of green flies in all their ugliness. There are fine paths all through this vast swamp, made several years ago by Russell H. Fellows for the benefit of his lumber interest. Only a few years ago, it was almost impossible to go over this swamp. Now a person can go nearly all over it with feet clad in low cut shoes."*

Can the clusters of large blueberries still be found in Spruce Swamp? Is it true that a walk through Spruce Swamp on a hot summer day is more refreshing than "basking in the sea-side sands?" Those who lived in Fremont years ago appreciated Spruce Swamp for the ecological treasure that it is. Let their wisdom inspire you to explore and appreciate the beauty and living treasures of this area.



15. Topographical Map of Oak Ridge Trails

Note: The trail map and the property line map came from different sources. They do not line up correctly in all areas.

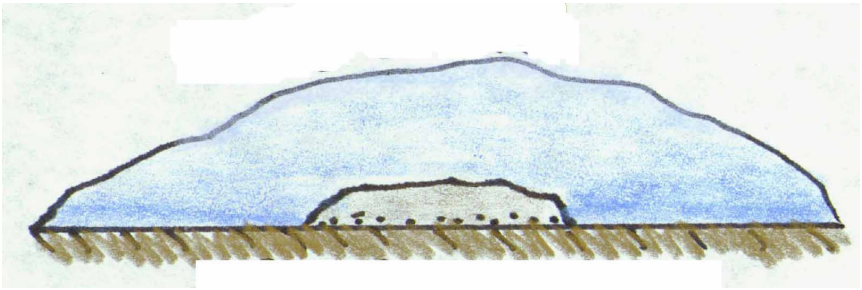


16. Aerial Map of Oak Ridge Trails

Oak Ridge Geology

How are Geology and the Wetlands Connected?
As the continental glacier known as the Wisconsin Ice Sheet receded from New Hampshire approximately 12,000 years ago, it left behind deposits of sand, gravel, rocks and boulders that created the landforms and soils that comprise the landscape of Oak Ridge Town Forest and Spruce Swamp today. Spruce Swamp is a wetland that has been designated as a prime wetland by the Town of Fremont because of its uniqueness and ecological value to wildlife and humans. Spruce Swamp is a complex wetland system which contains a poor-intermediate fen. A fen is a rare form of wetland that is sustained by groundwater. Fens have high water tables and peat soils that take thousands of years to form. Fens are very sensitive to changes in water chemistry caused by changes in land use. It is the materials that were deposited by the Wisconsin Ice Sheet that form the stratified drift aquifer underlying Spruce Swamp and enable good storage of the groundwater in Spruce Swamp that sustains the fen and its diversity of plant and animals.

The Tavern Road Esker
The road/trail on the right at the intersection of Meetinghouse and Tavern Roads climbs the Tavern Road esker and meanders over to the Fremont Branch of the Rail Trail. This esker is a geological feature, a ridge formed of sand, sediments and stones that winds through the lower lying marshes that surround it. Ridge Road (now Tavern Road) got its name because of this ridge that mysteriously appears in the wetlands which encompass it. The esker is a landform created as the continental glacier known as the Wisconsin Ice Sheet receded from New Hampshire approximately 12,000 years ago. An ice sheet is a kind of large glacier that, unlike an alpine glacier, is not constrained by topography. Ice sheets create landforms by depositing the sand, gravel, and rocks bound within them as melting occurs while alpine glaciers carve out valleys by erosion. The Wisconsin Ice Sheet is estimated to have had an average thickness of 3500 feet. As the large Wisconsin Ice Sheet started melting from the bottom up and as it continued moving, tunnels were formed at its base. Meltwaters streamed through these tunnels under the ice sheet, depositing sand, sediments and stones that formed a ridge in the path of the ice sheet. The tunnels kept getting larger and larger as the ice sheet receded, creating higher elevations in the ridge being laid down by the melting ice sheet.



17. Gravel Collecting in Tunnel of Meltwater

The tunnels at the base of the ice sheet were formed parallel to the direction the ice was moving. Ridge Road got its name from the winding ridge left behind by the ice sheet, known as an esker. The esker forms the geological southern boundary of Spruce Swamp. The wetlands on the south side of the esker are not considered part of the Spruce Swamp prime wetland. As you cross over

the esker, notice the steep slopes on either side. For many decades in the 19th and early 20th centuries, before Town residents knew the importance of wetlands, garbage was dumped over the sides of the esker into the Swamp (*The History of Fremont, N.H*, by Matthew Thomas). The esker is usually dry and a pleasant walk to the Fremont Rail Trail because of the higher elevation and dryness of the ridge.

The southern section of Tavern Road, formerly Ridge Road, was closed from south of 62 Tavern to Main Street at Town Meeting in 1943. Old Ridge Road was closed at Town Meeting in 1928. *The History of Fremont, N.H*, by Matthew Thomas, details homes that were located on the now closed sections of Tavern and Old Ridge Roads.

4.22 Management of Oak Ridge Town Forest

On August 24, 1982, after nearly two years of negotiation with the Society for the Protection of New Hampshire Forests, the Town of Fremont, with the Fremont Conservation Commission acting as its agent, obtained nearly 109 acres of land bordering the western edge of Spruce Swamp. This acquisition was approved prior to its completion, at the 1981 Town Meeting. The Fremont Conservation Commission was delegated control and supervision of these lands at that 1981 Town Meeting. This land included parcels at Map 4 Lots 9, 10, 11 and 12 on the Fremont tax map. These parcels were acquired by the Town with 50% of the purchase price donated to the Town by the Society for the Protection of New Hampshire Forests and 50% coming from a federal Land and Water Conservation Fund (LWCF) grant. The grant was applied for by the Fremont Parks and Recreation Commission. The land was deemed recreational land. The spirit of the agreement between the Society and the Town was that the land be used for recreational purposes compatible with conservation practices. Because fifty percent of the land was purchased with federal monies, the land must remain open to all of the people of the State of New Hampshire. The grant requires that "buildings and facilities included in this project are designed and constructed so as to be accessible to and usable by the physically handicapped." See the grant documents for accessibility details and other grant requirements.

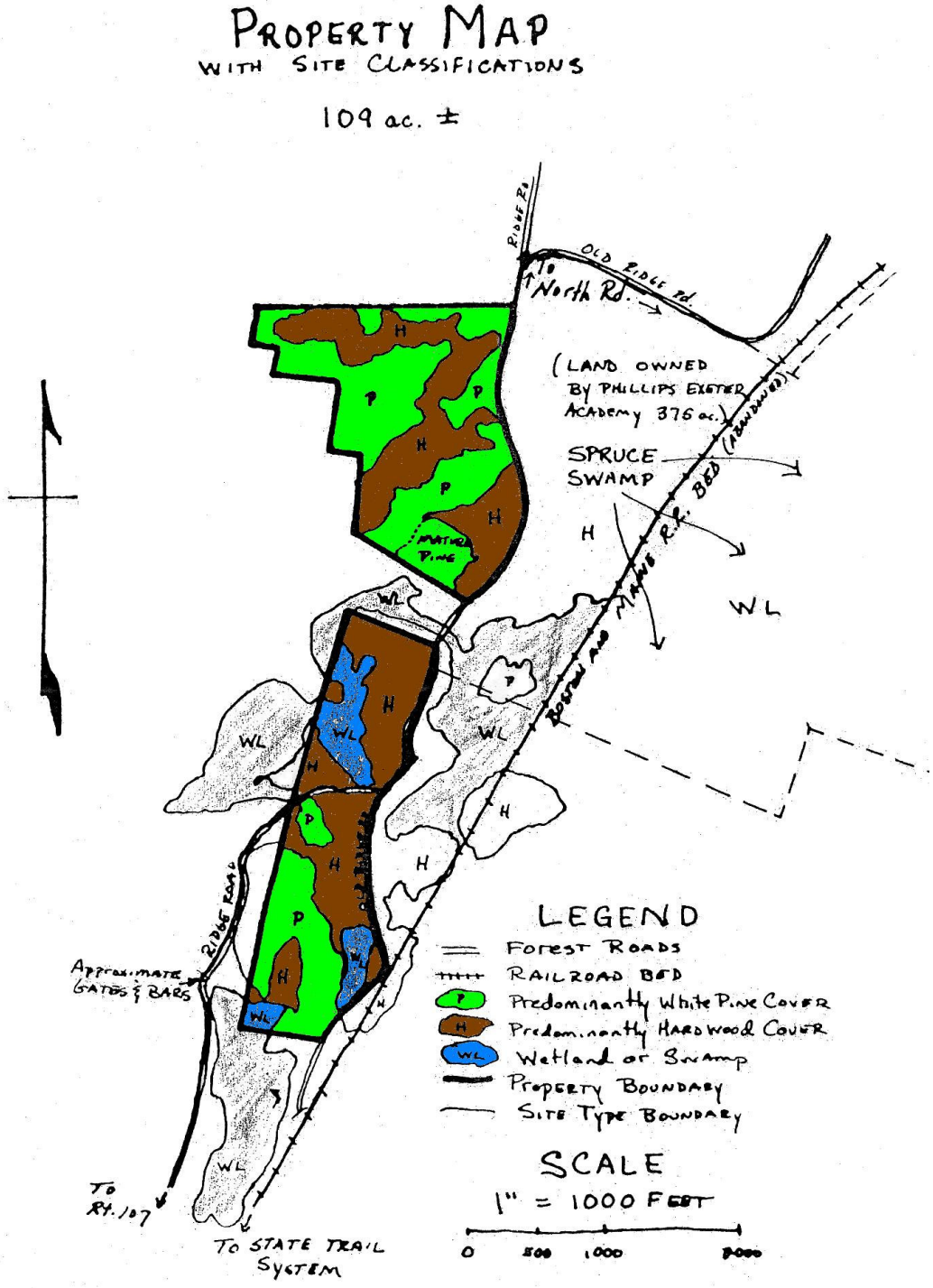
Parcels at Map 4 Lots 4, 8 and 16 were acquired by the Town via tax sale in 1990, 1994 and 1990 respectively. They were added to the Town Forest know as the Oak Ridge Conservation Area for conservation purposes at Town Meeting in 2003.

The Conservation Commission seeks to sustain all forest values including non-timber values such as plant, fish and wildlife habitat and water and air quality. The Commission desires to improve long-term forest health and productivity by protecting the forest with management practices that protect the ecosystems and prevent fire, pests and diseases while enabling recreational and educational use. The Conservation Commission under the direction of the Selectmen is working on a Town Forest Ordinance with the above goals in mind.

In the winter of 1991, the Chairman of the Conservation Commission met with Selectmen Bolduc and Holmes. They recommended that the land be surveyed before starting any land management plan. Donald A. Wilson, R.L.S., R.P.F. (Land and Boundary Consultant of Newfields, NH) was hired to research and compile the relevant data necessary to establish with accuracy the boundaries of the property. When the land record research was complete, an article was placed in the warrant for the Fremont Annual Town Meeting in March, 1992, for funds to cover the cost of the survey, including the placing of corner markers. The funds requested were based on the low bid figure offered from the three proposals submitted. The article was rejected at Town Meeting. The Conservation Commission then contacted Richard Parker of Parker Survey Associates our remaining viable options for proceeding without delay on a very limited budget. Mr. Parker agreed, for a minimal cost, to flag the boundaries as closely as possible without using a transit or other instrument and without setting any permanent markers. To this

date, no survey has been completed. The Conservation Commission continues to discuss the importance of marking and posting the boundaries of this property to insure accuracy when timber is harvested and when signs are installed. An accurate survey with the boundaries clearly marked will enable users of the property to be good neighbors to the property abutters.

In the summer of 1992, the Commission began working with Charles Moreno, a professional forester, to develop a management and timber harvest plan that promotes and practices sustainable forestry. Below is a map he sketched of the site classifications of the Oak Ridge Conservation Area at that time.



Site Classifications of the Oak Ridge Conservation Area (1992-1993)

Oak Ridge Timber Harvest

Two light harvests, one on the North Lot and the other on the South Lot have been performed under the supervision of Mr. Moreno.

There are several themes with the management work practiced so far:

1) Both were examples of low-impact, carefully executed logging.

2) The north and south sections provide juxtaposed examples of the application of biomass and conventional logging.

In terms of the forestry applied:

3) In both harvests, the poorer trees were removed, while the promising more valuable trees were retained to grow for the future.

4) Both harvests are sustainable in 12+/- year term, that is, the timber volume harvested will more than grow back in this time frame. To accomplish this, both harvests were light in magnitude, and trees to harvest were marked by a Forester.

5) Wildlife management measures were incorporated into the harvest.

Mr. Moreno stated that *"Wildlife habitat is improved in conjunction with harvest activity with specific treatments, such as creating small openings on the edges of wetlands. Low impact recreational usage of the properties by the public may be encouraged with trail development and regulated access. Finally, Tree Farm certification and educational tours of forestry activities on the property will help "spread the word" for using conservation and careful forestry practices in the harvest of woodlands."*

In his proposal dated October 7, 1992, Mr. Moreno stated that, *"The soils throughout the property are well-drained, and are best suited for the growth of white pine. Oak saw timber growth is also possible on this type of site, though trees will generally grow no more than one log in height before branching-out. White pine is presently not a major component of this forest, as much of it was harvested in years past. The various oak species – red, black and white – are well represented, particularly in the southerly section. Other, less-favorable species, such as beech, black birch, and hemlock, stock much of the property, especially in the north."*

North Lot – Tax Map 4 Lots 9, 10, and 16
(Lots 4 and 8 were not part of the Town Forest when the logging was done in 1995)

Mr. Moreno recommended a biomass (whole tree chipping) harvest for the North Lot in his proposal dated October 7, 1992. *"…young beech saplings are prolifically invading many areas of the north. Biomass harvesting is suited to removing some of this under story as well as thinning larger trees in the over story, so that white pine can regenerate."*
"The costs for the biomass operation are higher, as marking and layout for this operation is more involved than for conventional logging."

Timber Harvest, 30± acres

A forest improvement harvest was conducted on the north section (about 40 acres) in Dec 1994 to Jan 1995. Biomass harvesting (contractor was Landex, Inc.) was used to carefully harvest poor quality trees and provide growing space to a healthy stand of red oak and white pine.

Regarding the North Lot timber harvest, Mr. Moreno stated, *"White pine was heavily harvested from the North Lot 30 to 40 years ago. Due to the sandy, well-drained soils, white pine is a very productive species on this property. I have therefore left almost all of the scattered residual large pine as a seed source (versus present harvest)."*

"Unfortunately, after the previous pine cut, a poor hardwood mix became established, including beech, black birch, and red maple. Red oak is also a fairly common species, but is unstable due to chronic gypsy moth attacks. From a silvicultural standpoint, it is best to move the species composition to more of a pine mix."

Timber Harvest – North Lot – 1994/1995

Gross Income	$3,443.67
Forestry Expenses (C. Moreno)	$1,335.37
Net Income to Town	$2,108.30

A walk-through with the Conservation Commission about 2 years ago showed a scenic, fast-growing forest in the area. Some of the land around this forest has been cut heavily in the past, and should not be confused with the Town's property. The north section is entering the period, over the next 5+/- years were it is ready for a follow-up improvement harvest.

South Lot – Tax Map 4 Lots 11 and 12

Recommended: October 7, 1992 by Charles Moreno – Conventional logging.

"The southerly section is generally stocked with cordwood-sized hardwoods needing a light thinning." *"This assumes that harvesting is confined primarily to cordwood and chips, for forest improvement purposes with very little saw timber volume harvested. (If harvest focused on saw timber, revenue to the Town would be substantially higher, however, this would not be in the best interest of the forest)."*

Timber Harvest: 2004 – 2005; ± 25 acres

The southern section was thinned for improvement purposes between June and December 2005. About 25 upland acres were covered. Logger Eric LaFramboise did the work "conventionally", i.e., with chainsaw and skidder. In addition to providing growing space to healthy, valuable trees, this thinning will provide some needed light to promote the existing young growth in this forest area.

The southern section will be ready in 2018-2023+/- for another harvest.

Timber Harvest – South Lot – 2005

Gross Income	$5,054.21
Forestry Expenses (C. Moreno)	$1,077.98
Net Income to Town	$3,976.23

Following completion of the South Lot harvest, a small parking lot was constructed at the Meeting House Road entrance. A trail was cut which followed the skidder paths. Public access to the southerly section of the Town Forest was significantly improved.

Timber Harvests – Total

Gross Income	$8,497.88
Forestry Expenses (C. Moreno)	$2,413.35
Net Income to Town	$6,084.53

Mr. Moreno made several other suggestions that have not been implemented but may be worthy of consideration in the future. One suggestion was to block cut carefully selected areas approximately 2 to 5 acres in size and then have volunteers reforest the cut areas by planting young pine trees. Selected block cuts would be performed with each regular forest harvest, roughly every ten to fifteen years. Another suggestion was for the Town to obtain Tree Farm certification within the Oak Ridge Town Forest. The Tree Farm system is a nationwide program that encourages forest owners to "actively manage their forests in a sustainable manner for multiple values".
Tree Farm certification is obtained through the New Hampshire Tree Farm Executive Committee or through a University of New Hampshire Cooperative Extension Forest Resource Educator. State Tree Farm Committee and may be given to woodlands that meet the following criteria:

1. 10 acres or more in size
2. under management, with an implemented plan that accounts for water quality, wildlife habitat, soil conservation and production of forest products
3. protected from fire, insects, disease and destructive grazing.

Oak Ridge Photos

Walking south on Tavern Road. Notice the water covering the road.

Overlooking one of the wetlands from the Marsh Trail

Another wetland view from the Marsh Trail

A beautiful wetland view from Tavern Road

View of Tavern Road heading south from the junction of Tavern and Meetinghouse Roads.

Another wetland view from Tavern Road

A handsome Blanding's Turtle spotted in the summer of 2005 near what is now the Marsh Trail.

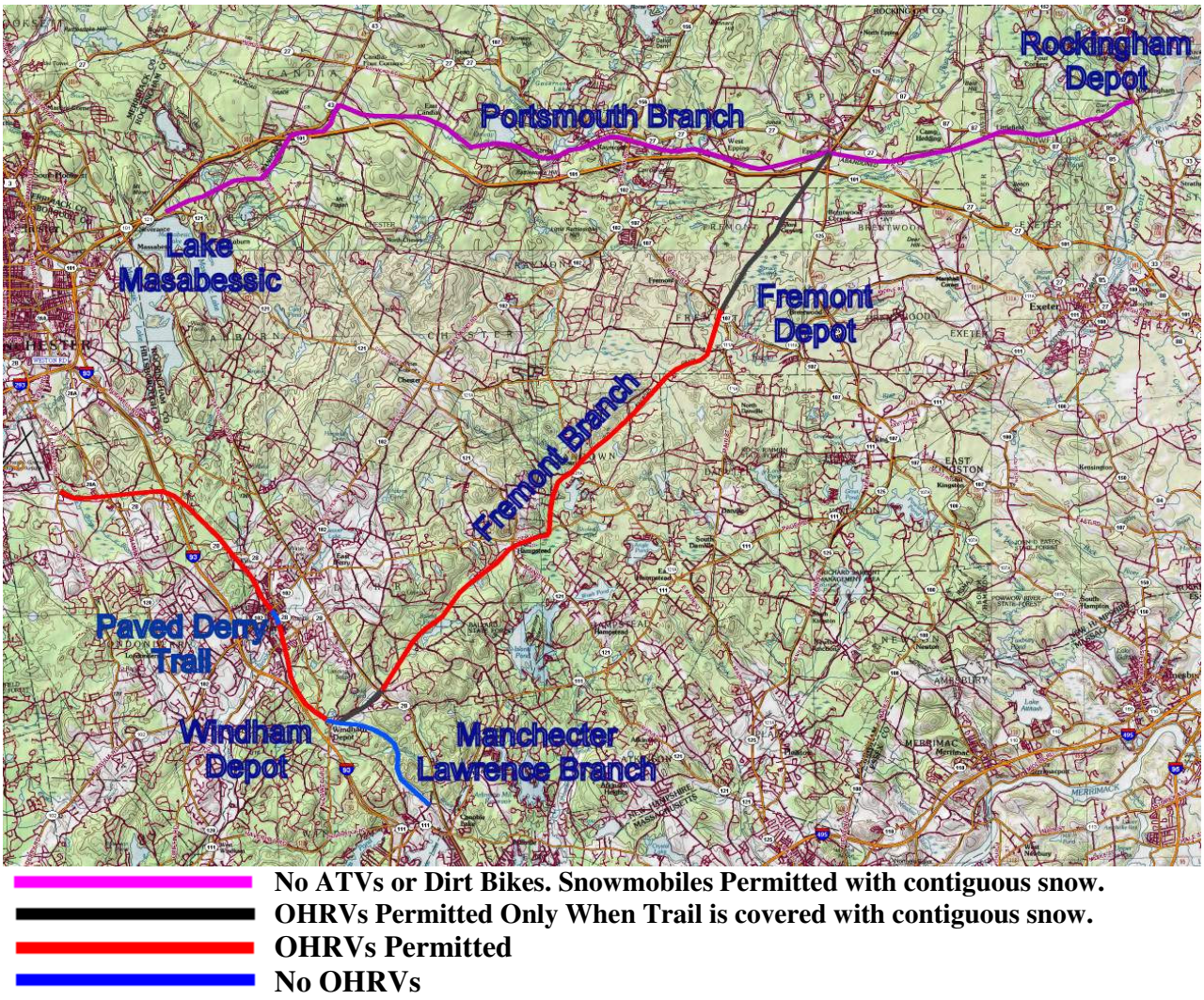
The Blanding's turtle has become camera shy.

4. 23 Recreational Rail Trail

Fremont has great access to the state abandoned rail trail system. The rules of use vary from section to section of the trails, and the rules periodically change as sections of the abandoned rail beds are developed. Check on the rules of use for each section at: http://www.nhtrails.org/Trailspages/RecRlTrl.html.Comprehensive bicycle/pedestrian map revisions are in progress and information is available, http://www.nh.gov/dot/nhbikeped/BicycleMapRevisionProject.htm.

Below is a view of the interconnected trails that are accessible from Fremont. The Portsmouth Branch Rail Trail extends east from Manchester through Epping to Newfields. From the Portsmouth Branch Rail Trail in Epping, the Rockingham Recreational Trail, Fremont Branch Trail extends south to the Fremont Depot, and then the Rockingham Recreational Trail continues further south to the Manchester/Lawrence Branch Recreational Trail, near the Windham Depot.

Note that the blue sections of trail are off limits to OHRVs.



Fremont Section of the Rockingham Recreational Trail - From the rail trail junction at North Road in Fremont, the Rockingham Recreational Trail, Fremont Branch, heads north to the junction of the Portsmouth Branch Rail Trail in Epping. The Portsmouth Branch Rail Trail extends west to Lake Massebesic in Manchester and east to the Rockingham Depot in Newfields. The total distance from Lake Massabesic in Manchester to the Rockingham Depot in Newfields is 25.3 miles.

Heading south from the North Road junction of the Rockingham Recreational Trail, Fremont Branch, the trail extends 4.4 miles to the Fremont Depot**.** The Fremont Depot was purchased by the State of New Hampshire through New Hampshire Resources and Economic Development from Thomas W. McGall of New Hampshire Pulp and Lumber Co. on March 11, 2002.

The Fremont Depot on Jackie Bernier Drive

Matthew Thomas's book, *History of Fremont, N.H.*, contains a wealth of information about the history of the railroad that came through Fremont including additional information about the Fremont Railroad Depot.

The Fremont Branch of the Rail Trail looking north from the Fremont Depot. The trail passes on the right of the barn.		Permitted trail uses between the Fremont Depot and North Road in Fremont

Motorized OHRVs including ATVs and trail bikes are not permitted on the section north of Route 107 unless there is ample, contiguous snow cover on the trail. This section of the trail goes through Spruce Swamp, which has been designated as a prime wetland by the Town of Fremont. The geological and natural features that can be observed from this section of the trail are very interesting and offer beautiful views of the wetland, which is actually a fen. Fens are a rare form of wetland that has high water tables and peat soils that took thousands of years to form. Fremont must conserve the upland buffer around this fen to protect it. Enforcement of the prohibition of OHRVs on the trails in Spruce Swamp is important to preserve the health of this fragile ecosystem.

From sightings of beaver dams and unusual species of plants and animals that live in this wetland to spectacular views of kettles, kames and drumlins, this is an enchanting walk.

From Fremont to Windham - South of route 107 in Fremont, the Rockingham Recreational Trail Fremont Branch extends to the Manchester-Lawrence Branch Recreational Trail. The Fremont Branch extends south through Sandown past the Sandown Depot. The Sandown Depot is owned and operated as a museum of local history by the Sandown Historical Society. The trail continues on through Derry, past the Derry Depot which is now a restaurant named the Depot Square Steakhouse, http://www.depot-square.com/ and on to the junction of the Manchester -Lawrence Branch Recreational Trail, near the Windham Depot. The Windham Depot was added to the Town of Windham's historic district at Town Meeting in 2003. http://www.windhamnewhampshire.com/boards/hdc/depotdist.htm. Access to this section of the Rockingham Recreational Trail, Fremont Branch from route 107 to Windham, is open to OHRVs but the resulting trail damage makes it difficult for hikers and cyclists to enjoy. When OHRV use is permitted, a frequent, heavy duty maintenance plan is needed to repair the ruts, holes and bumps these vehicles create.

Looking south of Route 107 to the entrance of the Fremont Branch Rail Trail

Manchester-Lawrence Branch Recreational Trail - The section of this trail in Windham that extends between North Lowell Road and Roulston Road (3.6 miles) is paved and closed to OHRVs year-round. The trail ends at Roulston Road. There is no further access from this point to the abandoned railroad bed that extends to Lawrence at this time. The paved section has beautiful views of woodlands, wetlands and water. It is enjoyed by walkers, joggers, cyclists, rollerbladers, scooters and families with strollers, wagons and tricycles. Dogs on leashes who are curbed and whose wastes are picked up are welcome.

There is a parking lot at the Windham Depot, on Depot Road, about 150 feet on the right from the junction of Depot Road and North Lowell Road.

From North Lowell Road, the Manchester-Lawrence abandoned railroad bed extends to the Manchester Airport. It is mostly, but not entirely, owned by the State of New Hampshire. Small sections of this trail are paved in Derry and Londonderry. OHRVs are prohibited on the paved sections. The Portsmouth Branch abandoned railroad bed and the Manchester-Lawrence Branch come together just south of Auger Street in Manchester. Some sections of the Manchester-Lawrence Branch may be inaccessible between Derry and Manchester.

A Salem to Concord bikeway feasibility study was done by Rizzo and Associates in 2003 as part of the I93 widening project. For the Manchester – Lawrence segment of this bikeway, a non-motorized, preferably surfaced trail that uses the abandoned railroad right of way has been proposed **-** http://www.nh.gov/dot/nhbikeped/pdf/BikePedFinalReport.pdf.
The study was done prior to the completion of the paved section in Windham, which has been closed to OHRVs year round. There are several groups of interested citizens working together to enable the bikeway to be built. **For the latest update on the bikeway project and more comprehensive maps of the NH abandoned railroad beds, visit** http://www.state.nh.us/dot/nhbikeped**.**

References

http://www.state.nh.us/dot/nhbikeped - information about the proposed Salem to Concord bikeway as well as current bicycle routes in New Hampshire.
http://www.nh.gov/dot/nhbikeped/BicycleMapRevisionProject.htm **-** latest information about map revisions of the bicycle/pedestrian maps including drafts of maps illustrating the current and proposed routes. The site also includes the meeting minutes of the steering committee for this project.
http://www.windhamrailtrail.org
http://www.nhtrails.org/Trailspages/RecRlTrl.html - rules of use for the state rail trail system.
http://www.nh.gov/dot/nhbikeped/pdf/BikePedFinalReport.pdf
http://www.nh.gov/dot/nhbikeped/pdf/Salem-ConcordDemandReport.pdf
http://members.fortunecity.com/railtrails/NH/index.htm.
http://www.americantrails.org/resources/statetrails/NHstate.html

4.24 The History of the Glen Oakes Property

Prepared by the Open Space Committee with assistance from and thanks to Matthew Thomas (Fremont Historian and author of the History of Fremont, N.H.) and Phil Auger (UNH Cooperative Extension)

How Did the Lawrence Family Acquire Glen Oakes?

Prior to the purchase of the 313 acres known as Glen Oakes by the Town, Glen Oakes was a 338 acre parcel owned by the Lawrence family. Oakes Kent Lawrence, Jr. was a pilot who enjoyed owning land and managing the forest. He began purchasing undeveloped land in 1960. He acquired the land piece by piece from different owners as each lot came up for sale. Upon completion of the purchases by Mr. Lawrence, this land totaled 577 acres.

How Did Glen Oakes Get Its Name?

Oakes Kent Lawrence Jr.'s wife's name was Glendora. The first names of the wife and husband were used to name two businesses of the Lawrence family. Oakes Kent Lawrence, Jr. transferred the property ownership to Glen Oakes, Inc. in 1983. Glen Oakes Associates acquired the property in 1988 from Glen Oakes, Inc. Even though there have been some title transfers between businesses owned by the family, the Glen Oakes property remained under the ownership of the Lawrence family until 313 acres were purchased by the Town of Fremont in 2005.

Early History of Glen Oakes - The Red Paint People

Indians were the first humans to call the land now known as Glen Oakes, their home. The Red Paint people are known to have lived along the Atlantic coastline in Maine around 10,000 years ago and may have also lived along the Atlantic coastline of New Hampshire. This time period is just after the Wisconsin ice sheet/glacier, which covered Canada and eastern New England including Maine and New Hampshire, melted. At the time of the melting of the ice sheet, Fremont, Epping and Kingston were “oceanfront property” and comprised part of New Hampshire’s coastline. “Red ochre,” otherwise known as iron oxide, is found at the Fremont Red Paint Mine near the fringes of Glen Oakes. According to an article that appeared in the Haverhill, MA, Weekly Bulletin on November 16, 1884, which is quoted in Matthew Thomas’ book the “History of Fremont New Hampshire”, page 300, "The main vein seems to run along this ridge and branches off at several points, running down into Spruce Swamp." Since the Red Paint people are known to have treasured "red ochre," the Red Paint people may very well have been in our area.

The details of the Red Paint people in Fremont are sketchy because no extensive archeological digs have been performed in this area of Fremont. It is believed that artifacts have been removed and/or were extensively damaged by mining and graveling. The article cited was written by a reporter who interviewed Mr. John Brown. Mr. Brown was selling 50 acres of his land to the newly formed “Fremont Paint & Gold Mining Company,” founded by a group of Haverhill businessmen in 1884. The article describes evidence of “dug pits” where the paint was taken out.

"The land on which the mine is located is the not very fertile looking pine land so common in southeastern New Hampshire. The location is slightly elevated, and a ridge of earth and rock runs through the fifty acre lot. The main vein seems to run along this ridge and branches off at several points, running down into Spruce Swamp. The paint and colored earth crops out in patches all over the tract, and where it is not visible above the surface a slight turning up of the leaf mold with a shovel discloses an earthy-looking substance, which in some places has a bright yellow tint, and varies in all the shades of yellow to a rich dark brown or terra cotta. The strata is usually found quite near the surface, the dark color on the top and the yellow deeper down. Holes dug in the ground at intervals show where the paint has been taken out in years past, and a shaft, which has been dug to a depth of fifteen feet, shows the point at the bottom in as good a condition as at the top. The ridge was noticed by Prof. Huntington when he was making his survey of the State of New Hampshire, and through him some of the members of the present company became acquainted with the value of the deposit."

This land has changed hands several times and has continued to be mined until the present, supporting the belief that the artifacts have been removed and/or extensively damaged.

The Squamscott Indians

The Squamscott Indians who lived in this area from about 1,000 years ago until shortly after contact with the Europeans are known to have used red ochre mixed with animal fat (such as bear grease) or sunflower oil as an insect repellent, for face painting, and for painting tools, pottery and clothing.

The Early Settlers of Southeast Fremont

There is evidence that a few settlers called Glen Oakes home. The Timothy and Samuel Davis cellar hole (1760's to 1790's) and the Moses Leavitt cellar hole (1768 to early 1800's) are on the Glen Oakes site. The Moses Leavitt Family Cemetery is near the cellar hole. The Israel Smith Sr. house dates back to the 1740s and is located on the western fringes of the Glen Oakes property. Two generations later, a member of the Smith family married a Tuck and named their son Israel Smith Tuck. The Israel Smith Tuck family owned this house between 1826 and 1891. Although the Tuck house is not on the Glen Oakes site, a portion of the land is now included in Glen Oakes.

From about 1720 until the 1850s, when a settler acquired property, the barn was built first. Then a small house with a partial basement, under only part of the house, would be constructed. After the barn and house were completed, land was cleared for farming and a vegetable garden was created. Only when all of the aforementioned tasks were completed did the settler consider expanding the house. The early settlers used red ochre to paint/stain their outbuildings.

Land Use by the Early Settlers

The stone walls and barbed wire fences that are found extensively on this property indicate that this land had been cleared for agricultural use early after the town's settlement. Because of the poor soils, this cleared land was primarily used for grazing

until just after the Civil War. After the Civil War, it is thought that grazing was abandoned and that the forest rejuvenated.

The Fellows Family Purchases the Land for Lumbering

Fremont has a very unique history, and Glen Oakes is part of that history.
In 1891, Russell H. Fellows purchased the Tuck house and 150 acres. The Fellows family owned a famous, productive brick factory on Martin Road, and also a Box Mill which was located in the western sections of Brentwood. They used tons of lumber from the 150 acres for the fires need to make boxes and bricks. Lumber was also sent to the Spaulding and Frost Cooperage to be used in making barrels. The fish, furs and forest products of southern New Hampshire were shipped worldwide from Portsmouth Harbor, easily accessible by area rivers. Spaulding and Frost of Fremont supplied the shipping containers, the famous wooden barrels that were made here until 1997.

How did Oakes Kent Lawrence, Jr. Manage the Property?

The land Oakes Kent purchased was heavily cut-over woodland. He got advice from then County Forester, Stan Knowles, and began to systematically "weed and thin" the young forests that had naturally regenerated there. Between 1964 and 1977 he thinned approximately 106 acres of the land. At about that time an energy crisis occurred in our region. The rebirth of fuel wood occurred. Kent took advantage of this and had low quality hardwood trees harvested each year.

Good Land Management by the Lawrence Family for Over Forty Years Has Yielded Productive Forest Land

Thanks to the good forest management practices of Oakes Kent Lawrence, Jr., this land currently has strong trees of good quality.

What Are "Log Landings?"

Log landings are cleared areas where lumbered trees are loaded for transport. Traditionally, "log landings" were located by rivers because the harvested timber was floated downstream. The "log landings" on the Glen Oakes property are where trucks were loaded with logs when the property was lumbered by Oakes Kent Lawrence, Jr. There are three of these landings on the property. These areas have been rejuvenated with wildlife. They are a valuable wildlife habitat for species that require open areas near woodlands.

Protecting Spruce Swamp

In 2000 the Fremont Conservation Commission designated Spruce Swamp “as one of three most environmentally sensitive areas in Fremont.” According to the 2000 Annual Town Report, the Commission was “devoting a substantial part of its time and resources to their study, restoration and conservation.” In the 2001 Annual Report, the Conservation Commission stated that “the single most distinctive and valuable environmental feature of Fremont is the area of wetlands known as Spruce Swamp.” The report also stated that the Commission “is exploring ways to insure the conservation and protection of this magnificent area in perpetuity.” In 2002, the Conservation Commission undertook the legal procedures necessary to have Spruce Swamp declared a prime

wetland by Town ballot in March, 2003. The amendment passed, and Spruce Swamp became Fremont's first Prime Wetland. With this designation, New Hampshire state regulations give it stronger protection from disturbance.

During the same time period, the Society for the Protection of New Hampshire Forests hired Mike Speltz as one of three land protection specialists whose job it is to acquire new land for protection. SPNHF requires that conservation easements be placed on SPNHF projects so that the land will be conserved and the natural resources protected "in perpetuity." Mike Speltz's area of focus includes the southeast area of the state, including Rockingham County. Shortly after he was employed by SPNHF, a year long study was undertaken to determine what needed to be protected. Spruce Swamp was at the top of the list! According to Mike, "Spruce Swamp is designated as a prime wetland, but that's not protection enough. The swamp is only as healthy as the surrounding uplands."

For Sale: Glen Oakes

Mike Speltz began contacting those who owned the land in and bordering Spruce Swamp. The Lawrence family was among those landowners contacted, and they were interested in selling their land. They had spoken with developers early in 2003 however they were interested in working with SPNHF and the Town to conserve the land "in perpetuity". In the fall of 2003, Mike made a presentation to the Conservation Commission on September 8, 2003 to gain support for land protection around Spruce Swamp. The estimated cost to protect all of the land described from his contacts with landowners was 4 to 5 million dollars. Fremont's newly organized Open Space Committee began working to gain support to have an Open Space Bond placed on the Town Meeting Warrant for March, 2004.

When the proposed Open Space Bond failed by six votes at Town Meeting, SPNHF worked diligently to come up with a plan that would "reserve the option for the Town to purchase the land" until the next Town Meeting where the residents had another chance to pass a bond that would enable the transaction. Several Fremont residents and SPNHF put up funds as a "deposit" on the land enabling the Lawrence family to agree to reserve the option to buy the land until Town Meeting, 2005. The Town residents privately funded 2/3 of the deposit amount. SPNHF funded 1/3 of the amount. If the bond failed again, the Lawrence family would keep the "deposit" and would be free to pursue other options. If the bond passed, the "deposit" money would be returned to the residents and SPNHF who donated it and the Town would purchase Glen Oakes.

The Open Space Committee worked very hard for the second year in a row to gain support for the 2005 bond. This time they targeted it specifically for the Glen Oakes project. The bond passed in 2005, providing the funds needed to purchase Glen Oakes.

The Purchase of Glen Oakes by the Town of Fremont

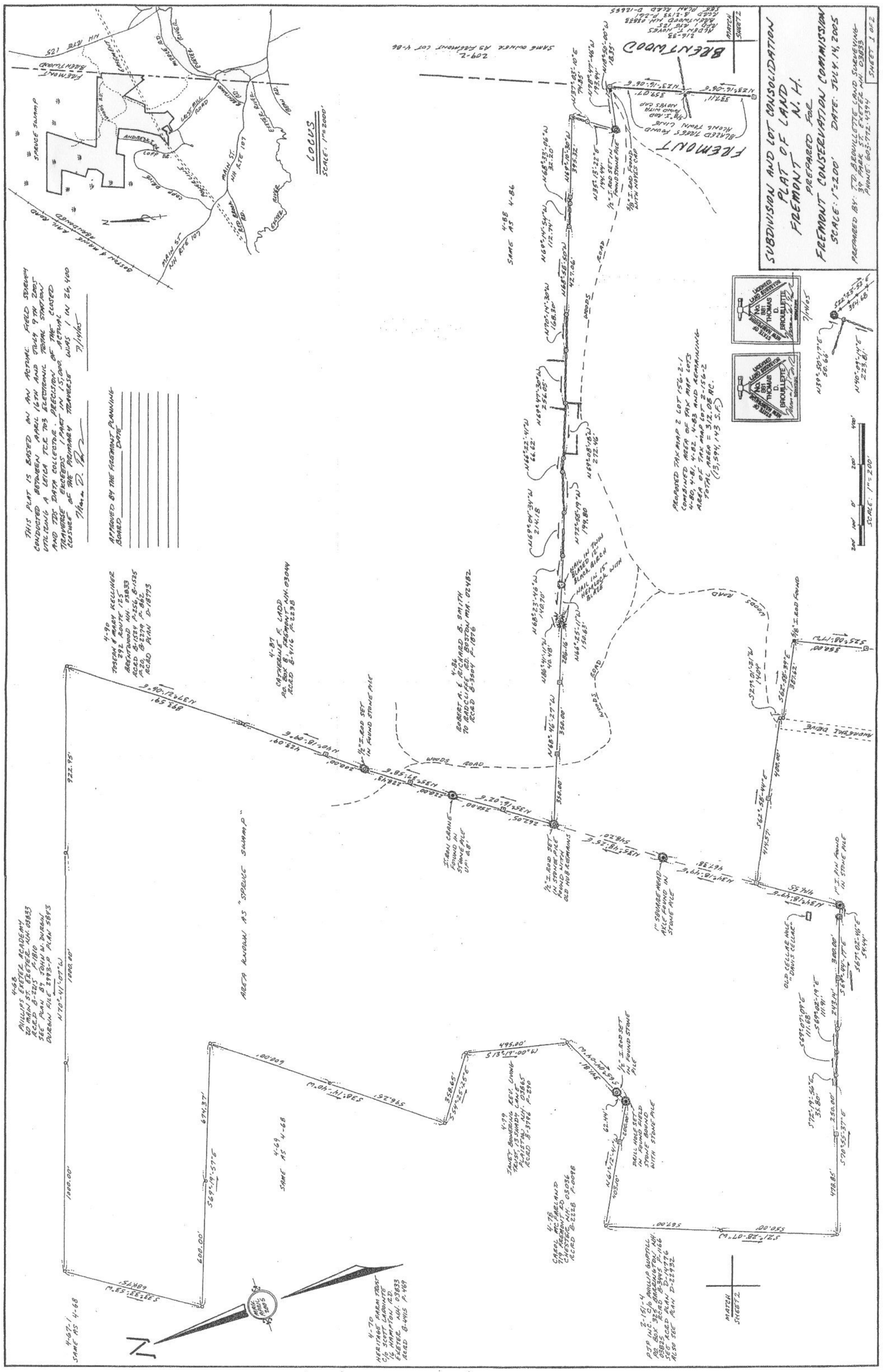
313 acres of the Lawrence property were purchased by the Town of Fremont on December 8, 2005. An easement protecting this property from development is held by the Society for the Protection of New Hampshire Forests (SPNHF). Another 25 acre easement was recorded at the same time for property which abuts Glen Oakes and which

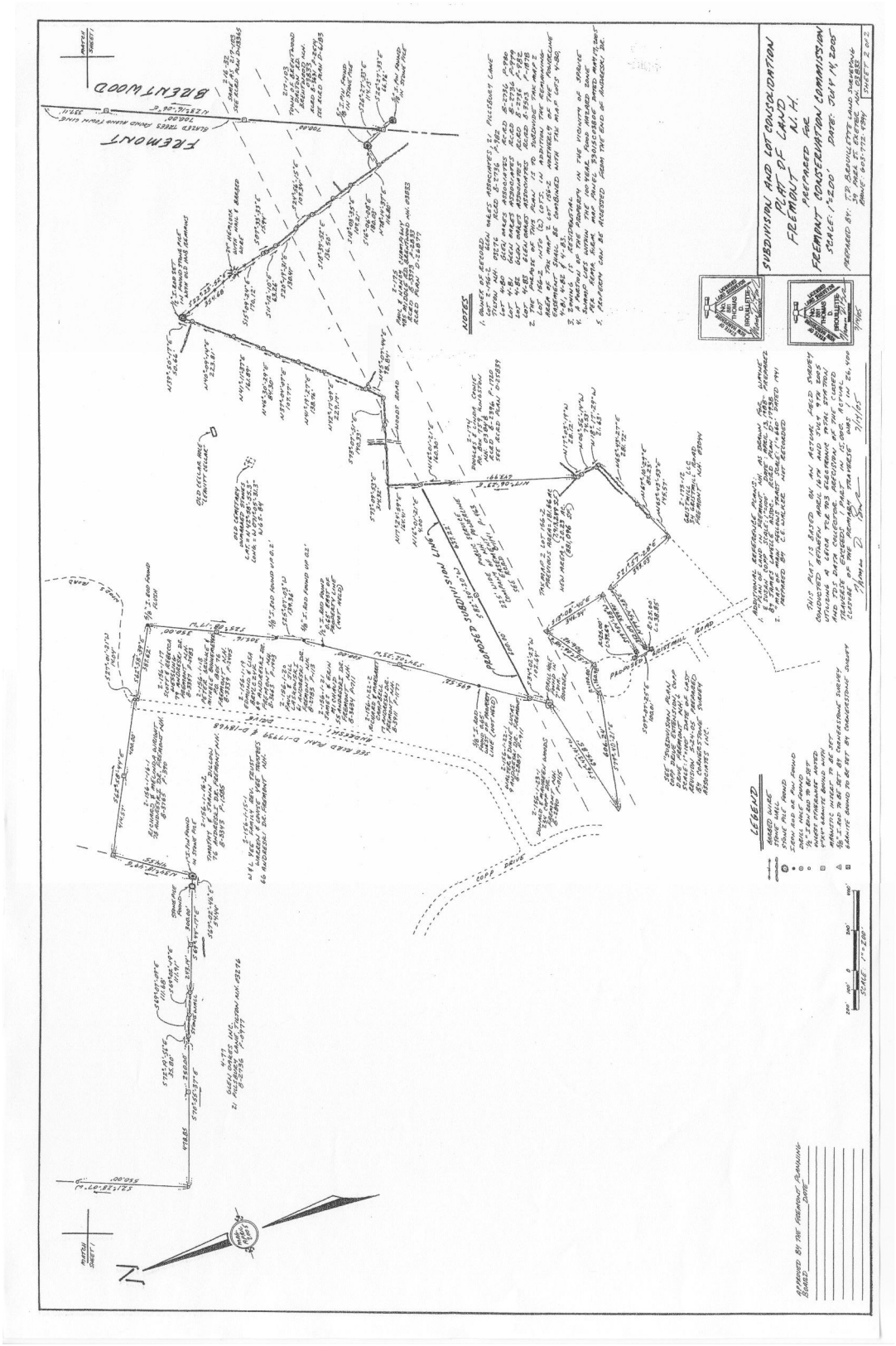
has been retained by the Lawrence family. This easement is also held by the Society for the Protection of NH Forests. Thanks to the efforts of the Society for the Protection of NH Forests, a total of 338 acres have been protected at the southern boundary of Spruce Swamp through the Glen Oakes project. This land encompasses a portion of Fremont's prime wetland known as Spruce Swamp. Most of the protected land provides an upland buffer to the southern boundary of Spruce Swamp, and will help to maintain the unique, rich habitat and the water quality of this environmental treasure.

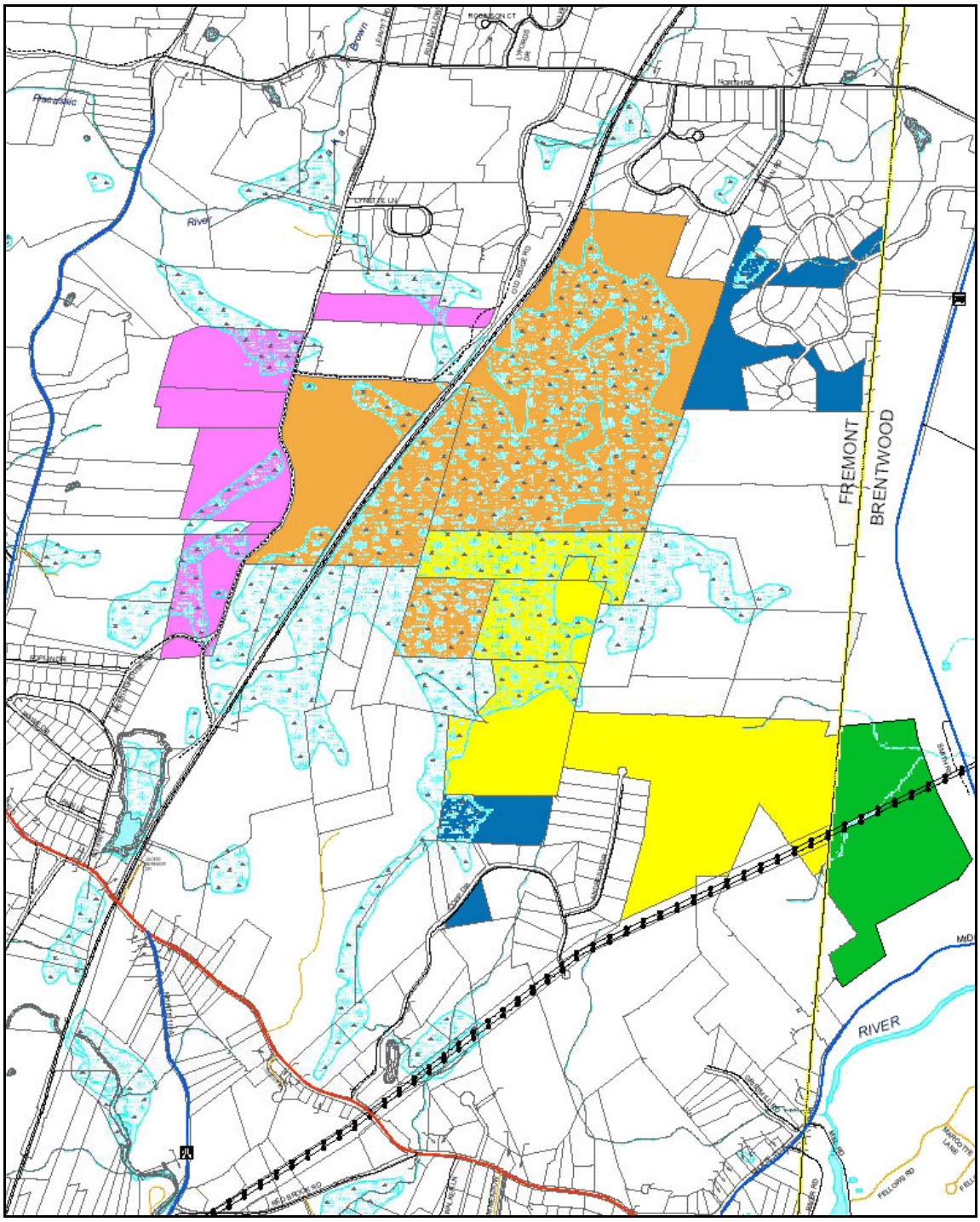
Sadly, Oakes Kent Lawrence, Jr. passed away on August 7, 2005 following a period of failing health. His family of four sons and a daughter, under the leadership of son Charles A. Lawrence completed the work begun by their father when they finalized the sale of the property to the Town of Fremont for the enjoyment of its citizens "in perpetuity."
The Town of Fremont received a Moose Plate grant for $50,000 from the NH State Conservation Committee and a grant of $20,000 from the NH Trails Bureau's Recreational Trails Program to be applied to the purchase of Glen Oakes. The Town also received a $3,000 grant from the NH Estuaries Project to be applied towards the transaction costs of the property acquisition.

We are very grateful to the following for making it possible for the Town of Fremont to purchase Glen Oakes:
Oakes Kent Lawrence, Jr. and the Lawrence family
The Society for the Protection of New Hampshire Forests
The NH State Conservation Committee (Moose Plate Grant)
The NH Trails Bureau (Recreational Trails Program Grant)
The NH Estuaries Project (transaction grant)
The citizens of Fremont
The residents who funded the "option to purchase" Glen Oakes. This legal document reserved the opportunity to buy the land for the Town until the citizens passed the bond to fund the purchase at Town meeting in March, 2005.

Below is a copy of the survey of Glen Oakes that was done by Thomas Brouillette. It is recorded as Plan D-33045 at the Rockingham Country Register of Deeds.


SUBDIVISION AND LOT CONSOLIDATION
PLAT OF LAND
FREMONT N.H.
PREPARED FOR
FREMONT CONSERVATION COMMISSION
SCALE: 1"=200' DATE: JULY 14, 2005
LOCUS
FREMONT
BRENTWOOD


SUBDIVISION AND LOT CONSOLIDATION
PLAT OF
FREMONT
LAND
N.H.
FREMONT CONSERVATION COMMISSION
SCALE: 1"=100' DATE: SEPT 14, 2005
PREPARED BY: TD BASCULLETT LAND SURVEYING
24 PARK ST. EXETER, NH 03833
SHEET 2 OF 2
NOTES
LEGEND
FREMONT
BRENTWOOD
PROPOSED SUBDIVISION LINE
OFF DRIVE



- Glen Oakes Town Forest
- Oak Ridge Town Forest
- Private Conservation Easement Land
- Lands of Phillips Exeter Academy
- Brentwood Conservation Land

This map was provided by the Rockingham Planning Commission

The Future of Glen Oakes

The acquisition of Glen Oakes is a project of regional significance that protects much more than the 313 acres that the Town now owns. The purchase of the Glen Oakes property has enabled an upland buffer to be protected that would have otherwise been lost to developers. Some of the Glen Oakes parcel lies within the designated prime wetland of Spruce Swamp, but much of it is upland buffer, dry and developable. Had Glen been developed, the water that supports the swamp and its vegetation and wildlife would have turned into surface drainage runoff and would be lost from the swamp. When water falls on undeveloped land, about five times as much seeps through the ground as runs off. When land is developed, this ratio is reversed: about five times as much runs off as seeps into ground. The runoff from the developed land contains far more contaminants. The amount of sediment, fertilizer, human sewage, animal waste, road salts, and pesticides running into Spruce Swamp, its surface water and underlying aquifers, and the Exeter River would have increased significantly.

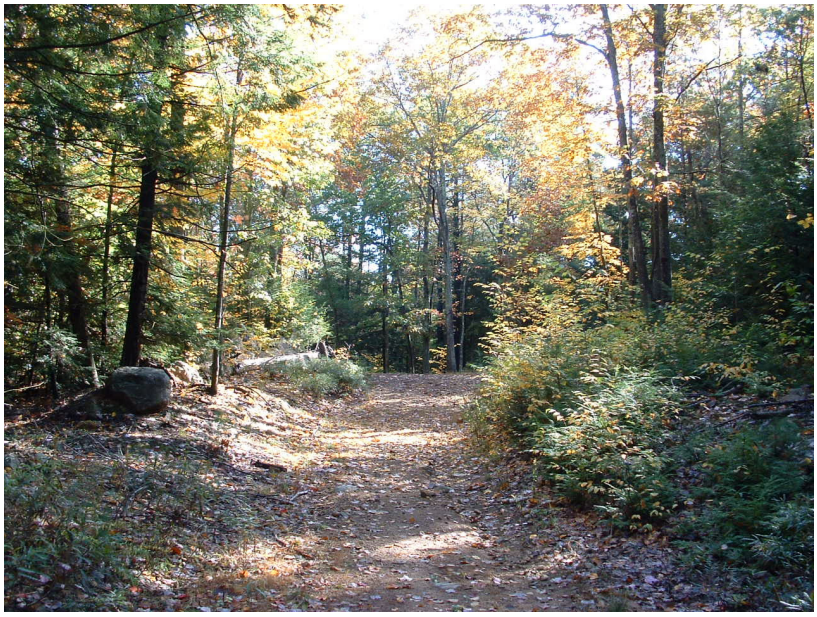
Plants which are being tracked by the NH Natural Heritage List have been found in the Prime Wetlands, which extend into the northwest corner of the Glen Oakes property. Important habitats for aquatic insects and amphibians, vernal pools for the wood frog and blue spotted salamander, and cover and nesting sources for a variety of birds have been identified during the Prime Wetlands Study. Great blue heron nests were found. Habitat for migratory and breeding waterfowl is present. The wetland supports habitat for large and small mammals including a major deer herd. The habitats that rare, threatened or endangered species require are present in Fremont's Prime Wetland. Since the Swamp is contiguous to and encompasses a portion of the Glen Oakes property, it is likely these rich habitats with their diverse plants and animals exist on the Glen Oakes property as well. Conserving Glen Oakes will help to protect the stratified drift aquifer underlying the swamp and the bedrock aquifer that lies under it and that most of the private wells depend on. Protecting Spruce Swamp by preserving its upland buffers protects the water quality and future supply of these aquifers. Preserving Glen Oakes is important for maintaining the water quality and water quantity of the aquifers.

Spruce Swamp has multiple outlets that feed into the Lamprey and Exeter Rivers. These rivers flow into the Great Bay Estuary and connect the wetlands to the estuary. Water is filtered by these wetlands as it proceeds to the rivers and on to Great Bay. Protecting Spruce Swamp and its upland buffers helps to protect the quality and quantity of water flowing into Great Bay.

The acquisition of Glen Oakes enables the preservation of wildlife habitat and Natural Heritage vegetation in Fremont's prime wetland, an ample supply of clean water for future generations, a highly functioning wetland that filters pollution from water flowing into the Great Bay estuary and southern New Hampshire history. Conserving Glen Oakes helps to insure that clean water continues to make life supporting connections throughout our area.

The Conservation Commission has contracted with Charles Moreno, a licensed forester who has also done work in the Oak Ridge Town Forest, to develop a forest management

plan for Glen Oakes. The Open Space Committee is recruiting volunteers to monitor the property on a monthly basis as well as volunteers to help with a wildlife inventory. The Conservation Commission and the Open Space Committee are working to insure that the land, plants and wildlife will be protected in perpetuity. They are seeking ways to enhance the recreational enjoyment of the property and provide environmental educational opportunities to the residents of Fremont.



Logging roads at Glen Oakes make wonderful hiking trails

Swamp overtakes part of the upland forest at Glen Oakes

Trees stand proud against the sky at Glen Oakes

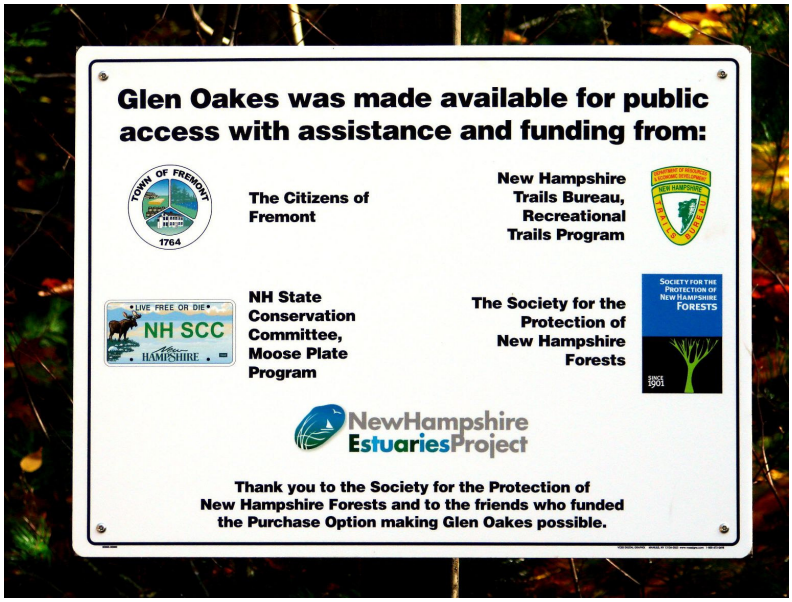
Hiking the trails at
Glen Oakes
(October 16, 2004)

Ladyslipper in bloom
at Glen Oakes
(June 2004)

The forest reclaims
an old cellar hole at
Glen Oakes
(June 2004)


GLEN OAKES
CONSERVATION AREA


WELCOME
to the
FREMONT TOWN FOREST
Please Do:
• Hike, observe wildlife, snowshoe, ski.
• Ride a horse and dog-sled only on established trails.
• Ride non-motorized bicycles only on established trails.
• Hunt and fish in accordance with the laws of the State of New Hampshire.
• Snowmobile on designated trails only.
Please Do Not:
• Camp.
• Kindle a fire.
• Erect any structure.
• Layout, construct and/or maintain any trail.
• Litter.
• Remove or damage any structure, trail, natural feature, plant or animal, except as the result of legal hunting or fishing.
• Construct or erect a permanent tree stand.
• Ride any motorized vehicle.
Allowed by Permit only:
• Trapping.
• Vehicular access for persons with disabilities.
PENALTY: The penalty for violation shall be a fine of up to $1,000 per offense.


Glen Oakes was made available for public access with assistance and funding from:
TOWN OF FREMONT
1764
The Citizens of Fremont
New Hampshire Trails Bureau, Recreational Trails Program
LIVE FREE OR DIE
NH SCC
HAMPSHIRE
NH State Conservation Committee, Moose Plate Program
The Society for the Protection of New Hampshire Forests
SOCIETY FOR THE PROTECTION OF NEW HAMPSHIRE FORESTS
SINCE 1901
NewHampshire EstuariesProject
Thank you to the Society for the Protection of New Hampshire Forests and to the friends who funded the Purchase Option making Glen Oakes possible.

5.0 Recommended Actions

The Fremont Conservation Commission recommends the following actions be taken to further the protection of natural resources in Fremont:

Water Resources - Wetlands

- Strengthen local land use regulations to increase protection around wetlands, including vegetative buffers around wetlands by adopting best management practices where/if appropriate.
- Improve enforcement of existing wetland protection regulations.
- Strengthen wetland zoning regulations to reduce the number of special exceptions and variances that are being granted.
- Protect wetland "clusters" by carefully reviewing future projects occurring in adjacent uplands and requiring conditions of subdivision or site plan approval for wetland protection to state on the plan and each deed "no further alteration of wetland areas permitted". A wetland cluster may be connected wetlands or several wetlands that are adjacent to each other.
- Determine the contributing areas for Spruce Swamp and prevent stormwater runoff from harming this area.
- Work with the NH Trails Bureau to put up a gate at the Route 107 entrance to the north section of the rail trail to prevent OHRV access.

Water Resources – River and Stream Corridors

- Preserve and restore riparian buffers along river corridors.
- Insure enforcement of the RSA 483 (NH Rivers Management and Protection Program), RSA 483-A (NH Lakes Management and Protection Program) and RSA 483-B (NH Comprehensive Shoreland Protection Act Identify and implement Best Management Practices for managing storm water runoff.

Water Resources – Drinking Water Supply and Groundwater

- Develop a future public water supply plan for Fremont.
- Develop a process and timeline for integrating "grandfathered" businesses in the aquifer protection district into compliance with the new regulations.
- Ensure strict enforcement of septic system design to prevent future septic failures. There have been several premature septic system failures in Tuck Woods.
- Restrict chemical pesticide and herbicide use in the aquifer protection district.

Wildlife Habitat

- Ensure developers work with the Planning Board to be aware of all possible consequences that may occur as a result of change to land cover.
- Minimize the effect on the ecosystem by developing a conservation district overlay for the Fremont tax map.
- Establish a wildlife inventory baseline in Town Forest areas for the purpose of monitoring change over time.

Natural Communities

- Document invasive species within Fremont
- Encourage low-impact recreation on town protected land, such as hiking and cross country skiing.
- Identify and protect natural communities within Fremont

Soil Conservation

- Ensure construction sites utilize Best Management Practices to minimize soil erosion and sedimentation
- Regulate building construction on slopes.
- Encourage parking lot design that minimizes unfiltered runoff.
- Use cover crops to protect against soil erosion.
- Maintain the topography of the land – make use of natural existing systems for drainage and storm water runoff.

Scenic Resources

- Identify and protect scenic views.
- Identify and protect historic trees.
- Promote attractive design in village and commercial districts.
- Develop a landscaping ordinance especially for businesses and in the village district to protect the character and scenic beauty of Fremont.

Land Conservation

- Develop an open space plan for undeveloped land in Fremont, incorporating the recommendations from the Land Conservation Plan for New Hampshire's Coastal Watersheds and the NH Fish and Game Wildlife Action Plan.
- Continue pursuing the protection of 25% of undeveloped land.
- Improve communication and outreach to surrounding communities to increase connectivity off conserved land.
- Focus on preserving the integrity of Spruce Swamp by protecting the undeveloped uplands surrounding the Swamp.
- Integrate ecological integrity and wildlife habitat into all aspects of town planning, including zoning and land use regulations and site plan review.
- Identify the "essential areas" for conservation in Fremont.
- Identify connectors for these areas.
- Identify connectors to neighboring conservation areas outside of Fremont.

Public Outreach and Education

- Instruct the public regarding how to protect vernal pools.
- Organize yearly cleanup efforts of the Town Forests.
- Sponsor yearly/periodic walks through the forest to enable residents and interested citizens to learn about Spruce Swamp and the Town Forests.
- Sponsor events to educate residents about septic tank maintenance.
- Educate residents about the harmful impacts of chemical pesticides and storm water runoff on our surface water

Glossary of Terms

bedrock geology - The solid rock that underlies loose material, such as soil, sand, clay, or gravel.

drumlin – A smooth hill shaped like a whale formed from deposits of glacial till. The long axis of the drumlin parallels the direction of flow of the former glacier.

esker - long, winding ridges of stratified sand and gravel deposits left by streams which flowed within and under glaciers. When the tunneled walls of the surrounding glacier melt, the deposits of the stream remain. Eskers are often several miles in length and resemble railroad embankments because of their shape

glacial till – a jumbled, unorganized (unsorted) mix of clay, sands and rocks of varying size and type picked up and dragged along by a glacier then dumped little by little as the ice melted. Glacial till is often compacted and not very porous or permeable.

kettle holes– Kettle holes are depressions in the surface of the earth left behind when ice blocks that broke off from the glacier melted. Kettle holes now hold water and range in size from small ponds to large lakes. Kettles are formed when till or outwash is deposited around ice blocks that have become separated from the active glacier. When the ice block melts, a hole remains in the center of the accumulated outwash material.

kame – an irregular mound or cone shaped deposit of sand and gravel laid down by meltwaters draining off of and around the tip of the glacial ice.

meltwaters – water that comes from the melting of a glacier. Glacial meltwater often forms streams and carries rock debris beyond active glaciers.

outwash - sand and gravel that is moved away from a glacier by meltwater streams and then deposited in front of, or beyond the margin of, an active glacier.

permeability - A measure of how well water will be able to flow through the spaces between the soil, sand, gravel and rocks in a particular area.

stratified drift – Layered (well-sorted) deposits of sands and gravels left behind by glacial meltwater streams. The permeability of stratified drift is greater than that of till.

surficial geology - Geology relating to surface layers, such as soil, exposed bedrock, or glacial deposits like sand, clay or gravel.

wetland – A wetland is characterized by its hydrology. Surface or ground water must be present at or above the soil surface for a sufficient period of the year to significantly influence the plant types and soils that occur in the area. Plants (hydrophytes) must be present that grow in water or in soil that contains excessive amounts of water and thus has very low oxygen levels.

hydric soils – wetland soils show the effects of the presence of water. They may be mottled or squishy and spongy. They are saturated long enough during the growing season to have low oxygen levels.

jurisdictional wetland – a wetland that is subject to regulation by the Federal Government as represented by the US Environmental Protection Agency (EPA) and US Army Corps of Engineers (Corps) IAW Clean Water Act, Section 404, by the state government (NH RSA 482 – A:2 X.) as represented by the New Hampshire Department of Environmental Services and by the Town.

APPENDIX "A" MAPS


N1_Fre_NRI_LandUse_E_2007.pdf


N2_Fre_NRI_Farmlands_E.pdf


N3_Fre_NRI_ForestResources_E_2007.pdf


N4_Fre_NRI_Geologic_E.pdf


N6_Fre_NRI_Historic_E.pdf


N5_Fre_NRI_Groundwater_E_2007.pdf


N11_Fre_NRI_Wildlife_E.pdf


N10_Fre_NRI_Wetlands_E.pdf


N8_Fre_NRI_Unfrag_E_2007.pdf


N9_Fre_NRI_SurfaceWater_tabloid_2007.pdf


N7_Fre_NRI_OpenSpace_tabloid_2007.pdf

WATER RESOURCES MANAGEMENT AND PROTECTION PLAN:

A SUBSECTION OF THE FREMONT NATURAL RESOURCES MASTER PLAN CHAPTER

Fremont, NH
October, 2010

This report was paid for in part by a grant from the NH Office of Energy and Planning

WATER RESOURCES MANAGEMENT AND PROTECTION PLAN:
A SUBSECTION OF THE FREMONT NATURAL RESOURCES MASTER PLAN CHAPTER

X.1 INTRODUCTION AND AUTHORIZING LEGISLATION

The protection and wise use of the water resources are of critical concern to the Town of Fremont. With every person in Town dependant on private wells, or small scale public water systems drawn from local sources, for domestic, public, and business use, the quality and quantity of Fremont's groundwater must be protected from depletion and/or contamination. In general, there is a direct relationship between land use and water quality. Uses in areas with poor suitability can degrade and contaminate both surface and groundwater resources, increase flood hazards, destroy water-based wildlife and interfere with scenic and recreational values. It is the responsibility of the Town to take reasonable precautions to protect all water resources from incompatible uses and, in doing so, protect the health and general welfare of the community.

In addition to a desire to protect and manage the existing water resources the Town is also obligated to create a Water Resources Management and Protection Plan (WRMPP). The Municipalities of New Hampshire were given the authority to create a WRMPP, according to the following legislation:

4-C: 22 Local Water Resources Management and Protection Plans.

I. A municipality may include in its master plan a local water resource management and protection plan, hereafter referred to as the local water plan. Once the local water plan has been adopted, it shall be placed on file with the office in accordance with RSA 675:9. The plan shall be made available to the public upon reasonable request and payment for any costs incurred in the duplication of the report.

II. Implementation of local water plans shall be through the adoption and enforcement of municipal ordinances consistent with the plan and through such other measures as are appropriate and legally available to municipal government as tools to further the water protection objectives set forth in the plan. Assistance shall be available through the water protection assistance program established in RSA 4-C: 19 and programs of the department of environmental services as provided in RSA 21-O: 3, IX, to advise municipalities on appropriate implementation measures.

III. If a municipality determines there is an immediate need to develop or amend subdivision or site plan review regulations in the manner provided by RSA 675:6 or to prevent deterioration of a critical water resource through a zoning ordinance or amendment in the manner provided by RSA 674:23, II, it may adopt such temporary measures for protection of water resources. Such measures shall be valid as provided in RSA 674:23, III.

Source. 1987, 283:3. 1989, 346:2, 3. 1997, 196:3, eff. Aug. 17, 1997.

Reference to a water protection plan is also made in RSA 674:2.III (Master Plan; Purpose and Description).

III. (d) A natural resources section which identifies and inventories any critical or sensitive areas or resources, not only those in the local community, but also those shared with abutting communities. This section provides a factual basis for any land development regulations that may be enacted to protect natural areas. A key component in preparing this section is to identify any conflicts between other elements of the master plan and natural resources, as well as conflicts with plans of abutting communities. The natural resources section of the master plan should include a local water resources management and protection plan as specified in RSA 4-C: 22.

X.2 How to Approach Revising the Existing WRMPP?

The last time the Fremont's WRMPP was updated it was in the early 1990's and it was a standalone document. The last WRMPP that has an identifiable date is a paper document from July, 1992. As stated in the RSA above the WRMPP, or local water resources management and protection plan, is now a subsection that should be included within the Natural Resources Section of the Town's Master Plan. The Town of Fremont incorporated A Natural Resources Inventory (NRI) into a new natural resources master plan chapter. The existing natural resources chapter covers many of the topics previously covers in the WRMPP. These include a discussion of existing wetlands, surface water and groundwater. The wetlands section (4.7) covers the existing wetlands in Fremont by type and area, discusses the largest wetland complexes in or part of town, and has an extensive look at the Town's first prime wetland, Spruce Swamp. This section also reviews the existing wetland buffer requirements. The Surface Water section (4.8) examines the Town's two watersheds (Exeter River and Piscassic River), catalogs the Town's named rivers and streams, and defines and explains vernal pools of Fremont. The Groundwater section (4.9) examines the Towns existing groundwater resources including details on the existing stratified drift aquifers in Fremont, then explores drinking water, contamination sources and the threats imposed by impervious surfaces in succession. The existing Natural Resources chapter also makes several recommendations regarding Fremont's resources. Other topics covered in the existing (1990's) WRMPP include an examination of existing and future land use, septic system limitations, utilities and other infrastructure. Current questions about land use can be answered by the town's recently adopted revised Land Use master plan chapter that includes a future land use subsection. The Fremont Vision Section states clearly that the Town is currently not interested in developing a municipal water or sewer system. So, as for issues with existing septic and possible water or sewer infrastructure, is currently not a focus of the community. The issue of a future need for either municipal water or sewer infrastructure should be explored and addressed in the Town's future update of the Public Utilities chapter of the master plan.

Because many of the topics formerly covered by the WRMPP are now contained in more extensive, standalone document the role of this Document can be more plastic. This subsection of the Natural Resources chapter will therefore explore the current policies and recommendations concerning water resource management and protection of regional and state agencies and how these statements affect the municipality in its role as steward of the local water resources. This chapter will also explore some new research and

documentation that could affect the water resources of Fremont. The recommendations of the Natural Resources chapter, as they pertain to the WRMPP are reviewed and room is left for additional recommendations. Lastly, a section of suggested additions to the parent natural resources chapter are included.

The Local Government Center (drawing strongly on the Department of Environmental Services (DES) New Hampshire Water Resources Primer (December 2008) has stated their opinion[10] of the role of municipalities when it comes to managing and protecting the water resources. This is reprinted for review below. In addition the Intro to the DES Water Resources Primer is also included for the review and education of the Fremont Planning Board.

From the Local Government Center:

> While numerous state and federal programs and nonprofit organizations play important roles in understanding and addressing the state's water resources challenges, municipalities also play a crucial role in managing and protecting water resources, primarily through subdivision and site plan review regulations and ordinances related to wetlands, shoreland, stormwater and groundwater. DES and its partner organizations have published a number of model ordinances and guidance documents over the years to aid municipalities interested in addressing these issues. The most recent of these is Innovative Land Use Planning Techniques: A Handbook for Sustainable Development (October 2008), prepared by DES in partnership with the New Hampshire Association of Regional Planning Commissions, the New Hampshire Office of Energy and Planning and the New Hampshire Local Government Center.
>
> While municipalities can help manage and protect water resources, municipal land use regulations can also encourage—or fail to discourage—patterns of development that threaten the quality of water resources and exacerbate problems such as flooding, dam safety, the loss of riparian habitat, high seasonal water demand and low stream flows during dry periods.
>
> Stormwater management is an excellent example of the municipal role. While DES's Alteration of Terrain Program regulates projects that disturb 100,000 square feet or more (50,000 square feet is the threshold in protected shorelands), smaller projects are not effectively regulated unless a municipality takes on this role. As described in detail in Chapter 10 of the Primer, conventional approaches to stormwater management like detention ponds have caused significant degradation of surface water quality while reducing recharge to groundwater. While DES's new Alteration of Terrain regulations incorporate the latest understanding of effective stormwater management techniques, local land use regulations that require only conventional management practices fall short of what is needed to protect our water resources into the future. The Handbook contains a model ordinance that municipalities can use to implement state-of-the-art

[10] http://www.nhlgc.org/LGCWebSite/InfoForOfficials/townandcityarticles.asp?TCArticleID=156)

stormwater management practices, along with a broad array of other model ordinances and related information.

Stormwater management is also an example of how municipal actions cut across many water resources issues. Proper stormwater management contributes to water quality and, consequently, recreational value, replenishment of groundwater and preservation of natural streamflow while limiting the impact of development on flooding potential and on stormwater infrastructure.

Another example of the municipal role is in the protection of groundwater. While state laws and programs do address the location and management of land uses that pose the greatest hazard to groundwater, it is left to municipalities to restrict many other land uses that potentially threaten groundwater. Many municipalities recognize the importance of this hidden resource, which supplies 60 percent of New Hampshire residents with their drinking water, and have adopted aquifer protection or groundwater protection ordinances. Some have also worked with adjoining communities to protect shared groundwater resources.

In many ways, the role of municipalities extends into areas where the Legislature has been reluctant to extend the regulatory arm of state government. An example of this is the quality of water supplied by private wells. These wells supply water to 36 percent of the state's residents, but DES estimates that approximately 20 percent of the state's private wells supply water that contains levels of naturally-occurring arsenic that poses a public health risk. So far, there is no state requirement dealing with the testing of water from private wells, but a handful of municipalities have adopted regulations to address the issue.

The Primer points out again and again the need for improved cooperation between municipalities to protect shared water resources. Although the legal mechanisms exist for watershed-based or other regional approaches to land use regulation, and the experts agree that effective management must include this approach, it has not been widely embraced. Municipalities are clearly in the driver's seat in terms of improved water resource protection through coordinated actions.

What Do Municipal Officials Think About Water Issues?

As noted previously, DES and its partner organizations conducted a survey of legislators and local officials during October and November of 2008. The purpose of the survey was to gain perspectives in addition to those provided by the DES staff and reviewers involved in preparing the Water Resources Primer. Respondents to the survey included 114 state legislators; 175 members of local governing bodies; and 131 municipal planners, chairs of planning boards or conservation commissions, and their designees. The survey, whose results can be viewed and/or downloaded on the State Water Resources Plan Process website (see Resources, page 15), contains a wealth of information about issues of

importance, water-related capital investment plans and opinions regarding policy questions. The survey revealed the following.

Asked in an open-ended format about the top three water resources issues respondents would like to discuss with the governor, respondents most often mentioned the following:

•Water quality and protection (groundwater and aquifers being mentioned twice as often as either rivers and streams or lakes and ponds)
•DES enforcement and funding
•Water withdrawals, usually groundwater
•Wetlands

Of the 32 water resource issues that respondents were asked about in a multiple-choice format, the issues that more than 70 percent of respondents were very or somewhat concerned about were:

•Impact of development on water quality (82 percent)
•Potential contamination of existing wells and aquifers (77 percent)
•Loss of wetlands (75 percent)
•Water quality of streams and rivers (74 percent)
•Increased flooding (73 percent)
•Shoreland development (73 percent)
•Climate change (71 percent)

Percentages of respondents who indicated that their communities have plans to make major capital investments in each of the following categories in the next five years:

•Land conservation (33 percent)
•Wastewater treatment (25 percent)
•Water supply (23 percent)
•Stormwater system (18 percent)
•Wetlands mitigation (14 percent)
•Dam construction/maintenance (13 percent)

More than 50 percent of respondents answered “yes” to the following policy questions:

•Should the state direct more funds toward collecting and analyzing data necessary to determine water resource conditions in order to adequately develop water policy? (65 percent)
•Would you support raising additional money through user fees to protect land around vital water resources? (60 percent)
•Should additional state regulatory controls be enacted to minimize the impacts of new development on rivers, wetlands and groundwater? (59 percent)

•Should homeowners be required to test private wells when homes are sold? (57 percent)
•Should new developments be required to implement standards for lawn irrigation conservation? (56 percent)

More than 50 percent of respondents agreed (strongly or somewhat) with the following policy statements:

•Water resource protection is worth the investment. Eighty percent of respondents disagreed with the statement, "Sometimes it is okay to reduce water quality to promote economic development." Eighty-eight percent agreed that, "It is important to protect water resources even though it costs money."
•Cluster subdivisions with open space should be encouraged (79 percent agreed).
• [The respondent] knows enough about water resources in New Hampshire to make informed policy decisions (60 percent agreed).
•Local aquifer and groundwater protection programs/ordinances are inadequate (55 percent disagreed with the statement that they are adequate).

Of note is the significant alignment between the concerns of policy makers surveyed and the issues and key recommendations identified by experts and stakeholders in the Primer. New Hampshire is fortunate to have well informed policy makers at all levels of government.

Next Steps and the Municipal Role

Fortunately, New Hampshire has a tradition of constructive involvement by dedicated volunteers—as local officials and as members and directors of regional planning commissions, lake associations, local river advisory committees, volunteer river and lake monitoring groups, sporting groups, and the like. DES solicited the contributions of many of these groups when drafting the Water Resources Primer and plans to tap into this vein of citizen involvement as it holds a series of "road show" meetings throughout the state. (See sidebar, page 14.) DES's hope is that between the Primer, the survey and the public meetings, the Water Resources Plan process will benefit from a wide range of perspectives and result in an informed public discussion about the challenges New Hampshire faces and what needs to be done to address them.

While the public meetings do not represent the first or the last opportunity for the involvement of municipal officials, the meetings present a great opportunity to begin a discussion that can continue on several levels. First, reviewing the Primer and participating in the State Water Resources Plan discussions can help inform local water resources planning. Second, municipalities have a tremendous stake in the outcome of the State Water Resources Plan process. The issues with the most direct impact on municipalities include infrastructure funding needs and the respective roles of state and local governments in various aspects of land use management such as stormwater management and shoreland protection. However,

the most important issue for all concerned is how to ensure the protection and enhancement of the high quality environment that makes New Hampshire a desirable and economically vital place to live and work.

This article draws heavily upon the New Hampshire Water Resources Primer, (N.H. Department of Environmental Services, December 2008), edited by Sarah Pillsbury, Paul Currier and Paul Susca. For more information, visit:

http://des.nh.gov/organization/divisions/water/dwgb/wrpp/sessions.htm.

From the New Hampshire Water Resources Primer:

New Hampshire is a unique state with a quality of life that consistently rates among the highest in the nation (Public Service of New Hampshire, 2008). The water running through, over, and by New Hampshire has shaped the state's history and will influence its future. The wise management and protection of water resources is critical to New Hampshire's economic prosperity, public health and environment.

New Hampshire is a small state with plentiful, high quality water resources compared to other parts of the country. New Hampshire has almost 17,000 miles of rivers and streams, nearly 1,000 lakes and large ponds, and 238 miles of ocean and estuarine coastline. Groundwater in New Hampshire is found in fractured bedrock and in the sands, gravels and till left by past glaciers. There is great connectivity among New Hampshire's waters and both water quality and quantity are greatly influenced by what occurs on the landscape (see Figure 1-17, the fold-out graphic).

New Hampshire is also the fastest growing of all the New England states and our landscape will continue to change to accommodate the projected 260,000 new people that are expected to move to the state between 2005 and 2030 (New Hampshire Office of Energy and Planning [NHOEP], 2006). Hundreds of thousands of tourists come to New Hampshire each year to enjoy the state's beautiful lakes, rivers, mountains and coast in the summer and its ski areas, snowmobile trails and ice-fishing spots in the winter. Whether it is needed for drinking, manufacturing, recreating, waste assimilation, or ecosystem health, water is a cornerstone of New Hampshire's beauty and prosperity.

In 2003 a statutory Water Resources Committee was established in the Legislature to study water related issues. The New Hampshire Department of Environmental Services (DES), in conjunction with this committee, sought and acquired limited funding to begin development of a comprehensive water resource plan to ensure the sustainability of New Hampshire's water resources. Development of this primer to inform policy makers and citizens is an initial step toward development of a statewide water resource plan. Thanks to legislative actions and the hard work of many stakeholders, for the first time a description of

New Hampshire specific issues and topics related to surface water, groundwater, water quantity, water quality, water use and conservation, and water related infrastructure will be contained in one document.

New Hampshire has long been a national leader in the protection of water resources. Foresighted leadership by policy makers at the state and local levels on many water related issues has been occurring for more than a century in New Hampshire, starting with the protection and treatment of drinking water and other early regulatory and non-regulatory approaches to address septic systems, wastewater disposal, wetlands, surface waters, groundwater and dams. The primer was developed to provide policy makers with the information they will need to continue to protect water resources given the current and future challenges of increasing water demand, a changing landscape as economic and population growth occurs, multiple water users with competing needs, climate change, and aging water infrastructure for water supply, stormwater, wastewater and dams.

X.3 RECOMMENDATIONS

The recommendations from two documents, the 1992 WRMPP and the Existing Natural Resources Chapter have been reviewed and those that have yet to be accomplished or are ongoing have been included below.

In an effort to protect and wisely manage the water resources of Fremont, the Town can pursue a number of regulatory and non-regulatory efforts. Reliance on a single method is not advised. Rather, it is recommended that the Town use a combination of strategies. The following listing should not lead one to believe that every single suggestion needs to be implemented; rather, the items described below are an attempt to provide the Town with a variety of options for protecting and managing its water resources in a sound, rational manner.

Non-Regulatory Programs

1. The Planning Board should continue to keep in close contact with the Rockingham Planning Commission in order to keep accompanying inventory information up to date. The Board should consult with the Commission on new data sources to incorporate into this document, as well as use the Commission as an information source on new State and Regional developments concerning water resource issues and water resource plan requirements. This is an ongoing relationship in which the Rockingham Planning Commission and Panning Board effectively and regularly provide formal document reviews and updates as necessitated by ever changing infrastructure needs.

2. The Planning Board currently has a good working relationship with the Conservation Commission; this should be maintained and encouraged. The Boards often seek advisement from each other on a variety of planning issues. The result of this cooperation is an expanded perspective when dealing with planning issues and reviewing

development proposals. The interactions of these governing bodies can only enhance the Town's effort to plan for the future.

Specific issues which the Boards should cooperate on include; development plans which could have a substantial impact on wetlands, water quality, wildlife habitats, and other natural resources; water quality monitoring efforts; regulatory reviews and rewrites; and identifying lands which should be protected. The conservation commission has already protected several key parcels of land within Fremont, including Glen Oakes conservation lands. The Planning Board and Conservation Commission have maintained good working relationships and acknowledge the importance of the synergy between the two governing bodies. A number of volunteers share membership across multiple boards. This is an ongoing relationship that both organizations foster that helps identify other significant areas of Town to be protected.

3. The local School Board should consider instituting a stream study and water quality assessment curriculum. This is a program which can be set up with the assistance of the Biology Bureau of the NH Department of Environmental Services. The program is designed for grades five through eight, and involves indoor classroom activities and outdoor field observations. Aspects of the program include stream monitoring, water testing, and water resource protection methods. For more information please contact the DES Biology Bureau directly.

4. The local School Board should consider instituting the "Discover Spring Wetlands" curriculum designed by the Non-game Wildlife Program and the outdoor education Unit of the NH Fish and Game Department. The program is designed for fourth and fifth grade students, and involves indoor and outdoor activities related to wetlands education. For more information please contact the Information and Education Division of the NH Fish and Game Department.

5. A pamphlet on the proper maintenance of septic systems and leach fields has been prepared by the Granite State Septic System Designers and Installers Association in concert with the University of New Hampshire Cooperative Extension Service. The Town should consider obtaining this pamphlet for distribution on a community-wide basis. Perhaps it could be sent along with the property tax bills, or the Building Inspector could distribute the pamphlet when inspecting new or replaced septic systems. Current information is available on the Town's website. For more information please contact the University of New Hampshire Cooperative Extension Service. (603-228-1231)

6. Opportunities for household hazardous waste disposal are infrequent in the Rockingham Planning Region. Much of this can be attributed to the Rockingham Planning Commission's decision to suspend its household hazardous waste collection program due to costs. However, the Town should be encouraged to participate in any intra-community or regional household hazardous waste collection effort.

7. Educational programs on the proper storage and disposal of household hazardous waste should be considered. The pamphlet entitled "Hazardous Materials in Your Home",

prepared by the University of New Hampshire Cooperative Extension Service in conjunction with the Governor's Energy Office, is something which could be distributed on a Town-wide level. Perhaps sending the pamphlet along with the Town's property tax bills would be of benefit. For more information, please contact the University of New Hampshire Cooperative Extension Service. (603-271-2047 or hhw@des.nh.gov)

8. The Town should consider establishing a water quality monitoring effort at several locations: Loon Pond, the potential surface water contamination site along Midnight Sun Drive, and the two areas of septic system concentrations along the Exeter River. As mentioned previously, samples could be taken of the River at a point before the septic system concentration and at a point directly after. This should provide an assessment of what effect these concentrations are having on the River.

The previously mentioned areas should be tested at the very least on an annual basis; however, a semi-annual or quarterly testing program would be more appropriate. In terms of setting up a cost effective program, the water sampling should be conducted by the Town and the samples sent into a laboratory for evaluation.
The Town's Health Officer or the Conservation Commission would be a logical person (s) to undertake such an endeavor, however, any interested volunteer can be trained in the basics of water sampling. Water quality monitoring programs can be set up with the assistance of the Biology Bureau of the NH Department of Environmental Services, or the Freshwater Biology Group at the University of New Hampshire.
This recommendation recognizes that the availability of resources will directly affect its implementation.

9. The Fremont Conservation Commission should continue to work with owners of properties containing critical water resources to obtain such areas by gift, grant, or bequest, and/or obtain covenants or easements. This is a great way to protect environmentally sensitive lands at a minimal cost to the community in terms of tax dollars. It is possible the only costs associated with land protection efforts involving gifts, grants, bequests, and the establishment of covenants and easements would pertain to legal and recording fees. The outright purchase of environmentally sensitive would obviously entail substantial costs.

Fremont should make use of state land acquisition programs such as the Land Conservation Investment Program as a means of protecting environmentally sensitive lands. Semi-public and regional land protection organizations (such as the Society for the Protection of New Hampshire Forests and the Rockingham Land Trust) may also be helpful. As may be appropriate in certain circumstances, the Conservation Commission should consider including in the Capitol Improvements Program recommended funding for acquiring land within critical resources areas. This strategy should be pursued when non-fee land or easement acquisition effort are unsuccessful.

10. The Town should continue its efforts to stay informed on the Mottolo Superfund Site clean-up effort. Since hazardous materials from the site have found their way into the Exeter River, it would be wise of the Town to stay apprised of the remediation process

currently underway. In an ongoing relationship with the Exeter River Local Advisory Committee, the Planning Board currently remains informed on the progress of clean-up, as well as on other developments effecting the River.

11. The Town should endeavor to compile an inventory of all underground storage tanks throughout Town. Currently, only the ones registered with the State (1,100 gallons or more) and a few abandoned tanks are known about. Examples of such a data collection effort are limited in New Hampshire, however, the Town may want to consider the example of a neighbor. The Town of Hampstead recently sent out an underground storage tank inventory form to all property owners, and the results were better than expected. The Hampstead Conservation Commission is currently involved in mapping all of the tanks indentified through the inventory. For more information, please contact the Hampstead Conservation Commission.

In conjunction with the above task, the Town should consider developing an assistance program for the removal of underground storage tanks. Perhaps a pamphlet could be distributed which addresses the following items: tank placement and replacement, tank construction, leak detection methods, proper procedures for removal, and a description of the state program which offers limited financial assistance for tank removal and contamination remediation. The Town should coordinate its program with the Groundwater Protection Bureau of DES.
This recommendation recognizes that the availability of resources will directly affect its implementation.

The cost of putting these non-regulatory programs in place are expected to be variable and, in some cases, not possible to estimate at this time without further investigation. It is possible the Rockingham Planning Commission could provide technical assistance on the implementation of the recommendations listed above.

Any water resource protection effort worth pursuing will require the commitment of human and financial resources. It is recommended the Town make full use of interested civic groups and other volunteers as a cost effective means of enacting the above mentioned non-regulatory programs. It should not be necessary for the Town to hire additional personnel to conduct or oversee any of the above recommendations.

Regulatory Programs

Most of the regulatory program recommendations in the 1992 WRMPP have been accomplished. Below are the few that have not been completed and may warrant future attention by the community:

1. In an effort to aid firefighting efforts, the site plan review regulations should be amended to require all applicants to clearly mark the content of all above ground storage tanks with a minimum capacity of forty (40) gallons. This will cover the majority of above

ground storage tanks while exempting the small containers associated with outdoor barbecue units.

2. The site plan review regulations should be amended to give the Planning Board the power to require applicants wanting to establish a land use which utilizes potentially hazardous substances to submit a risk assessment study as part of their application, when appropriate. Items to address in such a study should include, but are not limited to:

A. The proximity of the proposed use to surface waters, wetlands, floodplains, aquifers, and public water supplies;

B. The susceptibility of the above mentioned water resources to contamination by the proposed use;

C. An estimate of the abutting population likely to be affected by the proposes use; and

D. Emergency plans and a clean-up strategy (including an emergency response plan) in the event of an accident.

3. Article IV of the zoning ordinance should be amended to require new or replaced septic systems comply with all applicable Town standards as well as the standards of the NH Water Supply and Pollution Control Division. Under the Town's current regulatory framework, the above conditions can only be applied to septic systems proposed as part of a subdivision or site plan. There is no mechanism in place which allows the Town to apply the above referenced standards to replaced systems or to new systems, unless the new systems are proposed as part of a subdivision or site plan. Adoption of this recommendation would be beneficial in terms of addressing the septic system concentration problem along the Exeter River. This is not meant to convey that existing septic systems be required to be replaced.

The recommendations from the Existing Natural Resources Chapter are:

Water Resources - Wetlands

- Strengthen local land use regulations to increase protection around wetlands, including vegetative buffers around wetlands.
- Improve enforcement of existing wetland protection regulations.
- Strengthen wetland zoning regulations to reduce the number of special exceptions and variances that are being granted.
- Protect wetland “clusters”.
- Determine the contributing areas for Spruce Swamp and prevent stormwater runoff from harming this area.
- Work with the NH Trails Bureau to put up a gate at the Route 107 entrance to the north section of the rail trail to prevent OHRV access.

Water Resources – River and Stream Corridors

- Preserve and restore riparian buffers along river corridors.

- Insure enforcement of the NH Shoreland Protection and Rivers Protection Act.
- Expand perennial stream buffers from a 100 foot naturally vegetated buffer to include all of the 100 year floodplain, steep slopes and freshwater wetlands near the stream.
- Identify and implement Best Management Practices for managing storm water runoff.

Water Resources – Drinking Water Supply and Groundwater

- Develop a future public water supply plan for Fremont.
- Develop a process and timeline for integrating "grandfathered" businesses in the aquifer protection district into compliance with the new regulations.
- Ensure strict enforcement of septic system design to prevent future septic failures. There have been several septic system failures in Tuck Woods.
- Restrict chemical pesticide and herbicide use in the aquifer protection district.

X.4 SUGGESTED ADDITIONS TO THE NATURAL RESOURCES MASTER PLAN CHAPTER.

The Aquifer section of the NRMP chapter should be revised to include the following descriptive information on Aquifers:

Groundwater is a concentration of subsurface water, occurring in unconsolidated earth materials and fractured bedrock formations. It is recharged through precipitation, snowmelt, and surface water infiltration. Aquifers are found where these materials and fractures are filled or saturated with water. If excessive compaction of the earth surface or extensive impervious cover occurs, the amount of surface water that infiltrates the saturated zones or groundwater recharge is reduced.

Aquifers having medium to high potential for groundwater yield occur in the seacoast region as glacial deposits of sand and gravel (unconsolidated materials) or in fractured bedrock. In terms of the hydrologic cycle, approximately one half of the average annual precipitation in the seacoast region is returned to the atmosphere as evapotranspiration, while the other half flows to surface waters or infiltrates as groundwater storage.

Stratified Drift Aquifer

Unconsolidated materials, called stratified drift deposits, contain sorted layers of gravel, sand, silt and clay. These deposits have high potential groundwater yield due to their permeability, or the abundance of interconnected pore spaces where water is stored.

1n 1993, the United State Geological Survey (USGS) completed a study of the region's groundwater resources. The report, Geohydrology and Water Quality of Stratified Drift Aquifers in the Lower Merrimack and Coastal River Basins, Southeastern NH, identified a large 110 acre stratified drift aquifer located roughly in the central area of Hampton, and extending into North Hampton. As shown on Map 6-Groundwater Resources (refer

to Appendix G), most areas in the aquifer have transmissivities ranging from 1,000-2,000 gallons per day and 2,000-4,000 gallons per day, with isolated areas having transmissivity of greater than 4,000 gallons per day (data source from a study by the U.S. Geological Survey and NH Department of Environmental Services, Water Supply Engineering Bureau, 2002).

Bedrock Aquifer

Fractured bedrock typically does not yield high quantities of groundwater compared with stratified drift deposits. Bedrock aquifers are more productive when the bedrock is covered by a layer of sand and gravel, which allows recharge to occur directly from the surface. These aquifers are usually adequate for domestic wells serving a small population, and therefore should not be overlooked as a contributing source of a community's water supply needs.

The following information should be added to the NRMP section on Groundwater Resources:

Water Use and Conservation

The Water Use Registration and Reporting Program was initially authorized by Chapter 402 Laws of 1983, and is implemented by the Department of Environmental Services (DES). The objective of the program is to gather accurate data on the major uses of the state's water and the demands placed upon individual aquifers, streams and rivers. To accomplish this objective, all facilities that use more than 20,000 gallons of water per day, averaged over a seven-day period, must register with DES. "Use" of water means the withdrawal of water from a source, transfer of water from one location to another, return of water to the environment, and facilities which may receive water from a public supplier or return water to a community wastewater treatment plant. The program is important for several reasons in that it provides: 1) basic baseline information regarding major water uses; 2) improved management of water resources through understanding of water use trends and projection of future water demands and associated effects, and 3) a tool for ensuring compliance with laws, regulations and water rights.[11]

The following information should be added to the existing Surface Water Resources section of the NRMP chapter:

Surface Water Quality Assessments

The NH DES Surface Water Quality Assessment Program produces two surface water quality documents every two years, the "305(b) Report" and the "303(d) List". As the two documents use the same data, the 305(b) Report and 303(d) List were combined into one Integrated Report starting in 2002. The Integrated Report describes the quality of New

[11] NH Department of Environmental Services, Fact Sheet CO-GEO-4 Water Use registration and Reporting in New Hampshire (2007)

Hampshire's surface waters and an analysis of the extent to which all such waters provide for the protection and propagation of a balanced population of shellfish, fish, and wildlife, and allow recreational activities in and on the water. Results of the 2008 305(b) report (after section 305(b) of the Clean Water Act) for the Hampton segments of the Taylor-Hampton River and Hampton Harbor are summarized below.

Designated Uses
All surface waters of the State are either classified as Class A or B, with the majority of waters being Class B. NH DES maintains a list that includes a narrative description of all the legislative classified waters. Designated uses represent the uses that a waterbody should support. Below are the Classification Designated Uses for Class A and Class B waters as described in RSA 485A:8.

Class A These are generally of the highest quality and are considered potentially usable for water supply after adequate treatment. Discharge of sewage or wastes is prohibited to waters of this classification.

Class B Of the second highest quality, these waters are considered acceptable for fishing, swimming and other recreational purposes, and, after adequate treatment, for use as water supplies.

Criteria. The second major component of the water quality standards is the "criteria". Criteria are designed to protect the designated uses of all surface waters and may be expressed in either numeric or narrative form. A waterbody that meets the criteria for its assigned classification is considered to meet its intended use. Water quality criteria for each classification may be found in RSA 485A:8, IV and in the State's surface water quality regulations (NHDES, 1999).

Antidegradation. The third component of water quality standards is antidegradation which are provisions designed to preserve and protect the existing beneficial uses and to minimize degradation of the State's surface waters. Antidegradation regulations are included in Part EnvWs 1708 of the State's surface water quality regulations (NHDES, 1999). The NHDES is currently developing specific antidegradation standards for water quality, which may be released in 2010. According to EnvWs 1708.03, antidegradation applies to the following:

- any proposed new or increased activity, including point and nonpoint source discharges of pollutants that would lower water quality or affect the existing or designated uses;
- a proposed increase in loadings to a waterbody when the proposal is associated with existing activities;
- an increase in flow alteration over an existing alteration; and
- all hydrologic modifications, such as dam construction and water withdrawals.

<u>Effects of Development on Surface Water Quality</u>

Studies conducted in the northeast have documented that by converting as little as ten percent of a watershed to impervious surfaces, stream water quality, stream channel structure, and species habitat begins to deteriorate. Above 25 percent impervious surface,

water quality is seriously degraded. The 2005 report *The Effects of Urbanization on Stream Quality at Selected Sites in the Seacoast Region in New Hampshire, 2001-03*[12] found sites with between 8 and 14 percent impervious surface in the watershed generally showed changes in stream quality as measured by reductions in the combined water quality, habitat condition and biological condition score for these sites. The Center for Watershed Protection (Ellicott City, Maryland) reports similar findings of the correlation of percent impervious surface coverage with degradation of water quality and in-stream habitat.

The Following should be added to the Shoreland and wetland buffer section of the NRMP Chapter:

NH Comprehensive Shoreland Protection Act

The NH DES Shoreland Program implements RSA 483-B, the Comprehensive Shoreland Protection Act (CSPA). The CSPA establishes minimum standards for activities within the Protected Shoreland – land within 250 feet of the state's larger water bodies - that are designed to protect the water quality and to fulfill the state's role as trustee of those waters. Effective July 1, 2008, the state legislature amended the CSPA to revise existing and include additional standards to protect water quality. These standards include new requirements for clearing trees and other vegetation within the Woodland and Waterfront Buffer, limitations on impervious surface coverage, restrictions on the use of fertilizer and pesticides, and setbacks for primary structures. For more information, refer to the NHDES Shoreland Program website at http://des.nh.gov/organization/divisions/water/wetlands/cspa/index.htm.

The following section should be added to the surface water resources section of the NRMP Chapter:

Designation of the Exeter River as a Rural River *(designation complete)*

Broad wetlands, forested riverbanks, and gently-flowing waters, interrupted by short stretches of rapids and falls, combine to make the Exeter River an important scenic resource as well as habitat for a variety of wildlife species in southeastern New Hampshire. As a major tributary to the Great Bay National Estuarine Reserve, the Exeter River also plays a vital role in maintaining the overall health of the bay's environment. For these reasons, the river has been recognized not only by the NH Rivers Management and Protection Program, but as part of the NH Resource Protection Project. Great Bay is one of six high priority areas in the state recognized as a resource protection site. This designation places an emphasis on protection of healthy resources (rather than restoration of impaired resources) throughout that ecosystem. A high level of water quality must be maintained in the Exeter River not only because of these designations, but because it is the primary source of municipal water supply for Exeter.

[12] Deacon, Jeffrey, R., Soule, Sally A., and Smith, Thor E., *Effects of Urbanization on Stream Quality at Selected Sites in the Seacoast Region in New Hampshire, 2001-03*, U.S. Geological Survey Scientific Investigations Report 2005-5103.

The Exeter River begins in the town of Chester and flows east and north to Exeter where it becomes tidal and changes name to the Squamscott River, before emptying into Great Bay. Its drainage basin encompasses an area of 126 square miles. The upper 33.3 miles of the river, from its headwaters to its confluence with Great Brook in Exeter, were designated into the NH Rivers Management and Protection Program in August 1995.

Land use along the Exeter River is primarily rural. In the upper reaches of the river, through Chester, Sandown and Danville, there are scattered farms and single family homes and the riverbank is well forested and interspersed with large areas of wetlands. In the lower reaches of the river, from Fremont to Exeter, there is more industrial and commercial land use.

The following should be added to the NRMP chapter:
The most current water use information available to date for the communities in the coastal watershed is the result of a cooperative effort by the NH Department of Environmental Services, the U.S. Geological Survey and local municipalities. These entities combined resources to develop groundbreaking information on groundwater resources in the 44 municipalities found in the NH Seacoast Region. Two publications were prepared as a result of this study and these documents give us the most comprehensive evaluation of the area's groundwater resources ever developed.

The first document, Methods For and Estimates of 2003 and projected Water Use in the seacoast Region, Southeastern NH, Scientific Investigations Report 2007-5157, USGS 2008 developed a methodology for determining water usage, as well as projecting water usage out to 2017 and 2015 for each community.

The second document, Assessment of Ground-Water Resources in the Seacoast Region of New Hampshire, USGS, New Hampshire Coastal Program and the New Hampshire Department of Environmental Services, Scientific Investigations Report 2008-5222, 2009, developed a mechanism to study groundwater flow in order to evaluate current and future groundwater availability.

These studies offer a wealth of data for the groundwater resource in the seacoast and serve to allow communities to have a much clearer picture of current water usage as well as sound scientifically supported indications of future groundwater availability. This enables communities to do water resource planning with a degree of sophistication that was unavailable in the past.

RIVER CLASSIFICATIONS
Rural
Activities Allowed
Dams & Encroachments
Construction of New Dams
No
Reconstruction of Breached Dams
Yes
(within six years)
Channel Alterations
Yes (with conditions)
Water Quality/ Water Quantity
Water Quality
Class B
Interbasin Transfers
No
Protected Instream Flow
Yes
Waste Disposal
New Landfills
No (within 250 ft.)
New Hazardous Waste Facilities
No (within 250 ft.)
Other New Solid Waste Facilities
No (within 250 ft.)
New Septic Systems
No (within 75 ft.)
New Auto Junk Yards
No (within 250 ft.)
Fertilizer
Limestone
Yes
Sludge and Septage
No (within 250 ft.)
Conditions apply
Low Phosphorus, Slow Release Nitrogen
No (within 25 ft.)

http://des.nh.gov/organization/divisions/water/wmb/rivers/exeter_river.htm